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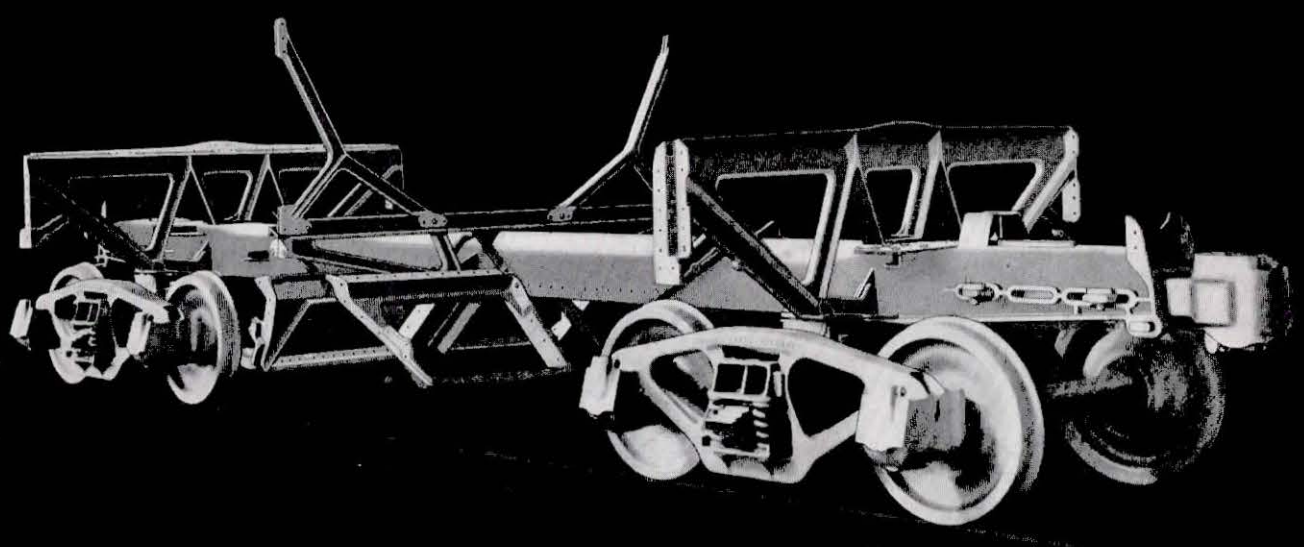
MARCH 16, 1935

Railway Age

FOUNDED IN 1856

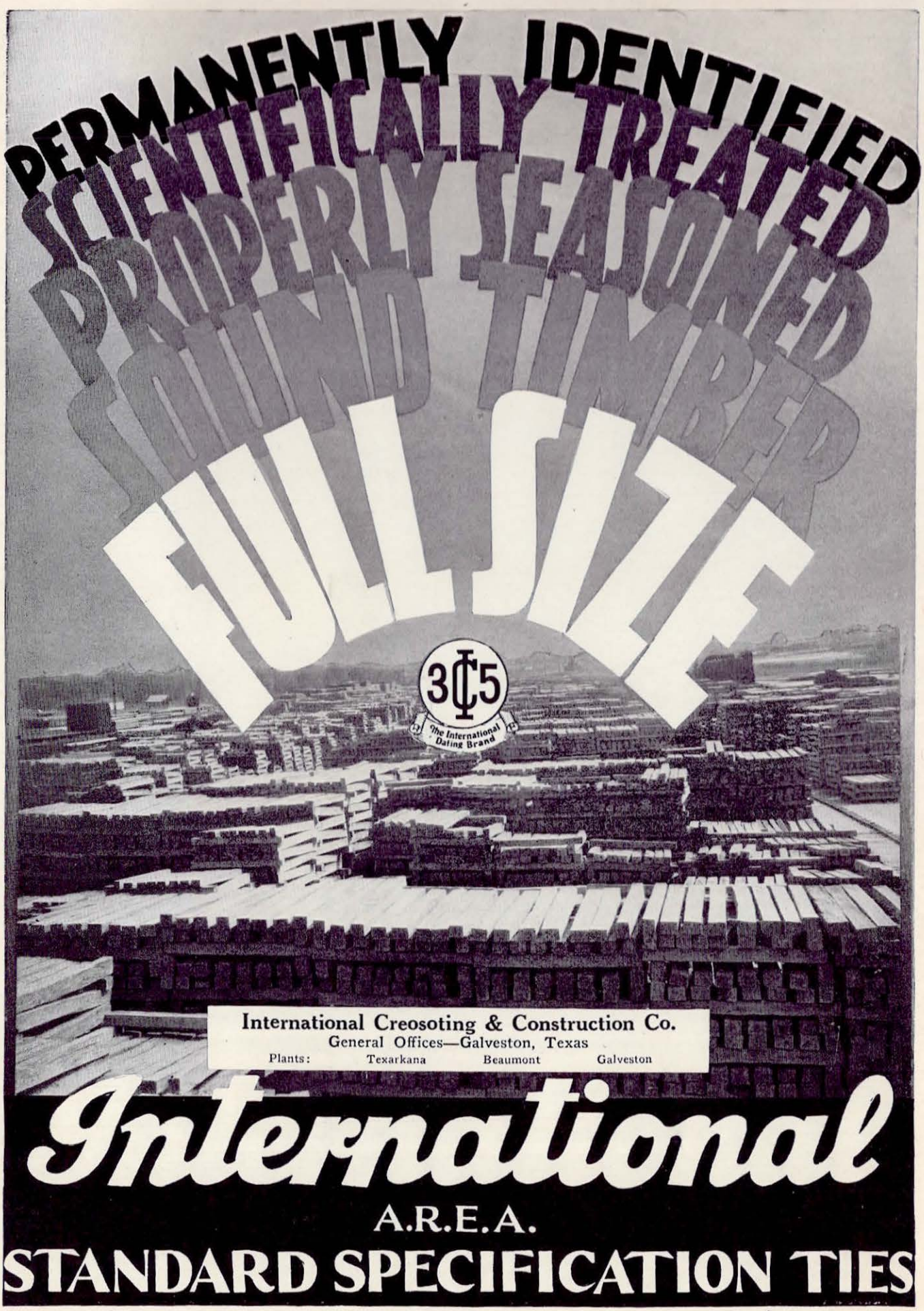
PERMANENCE



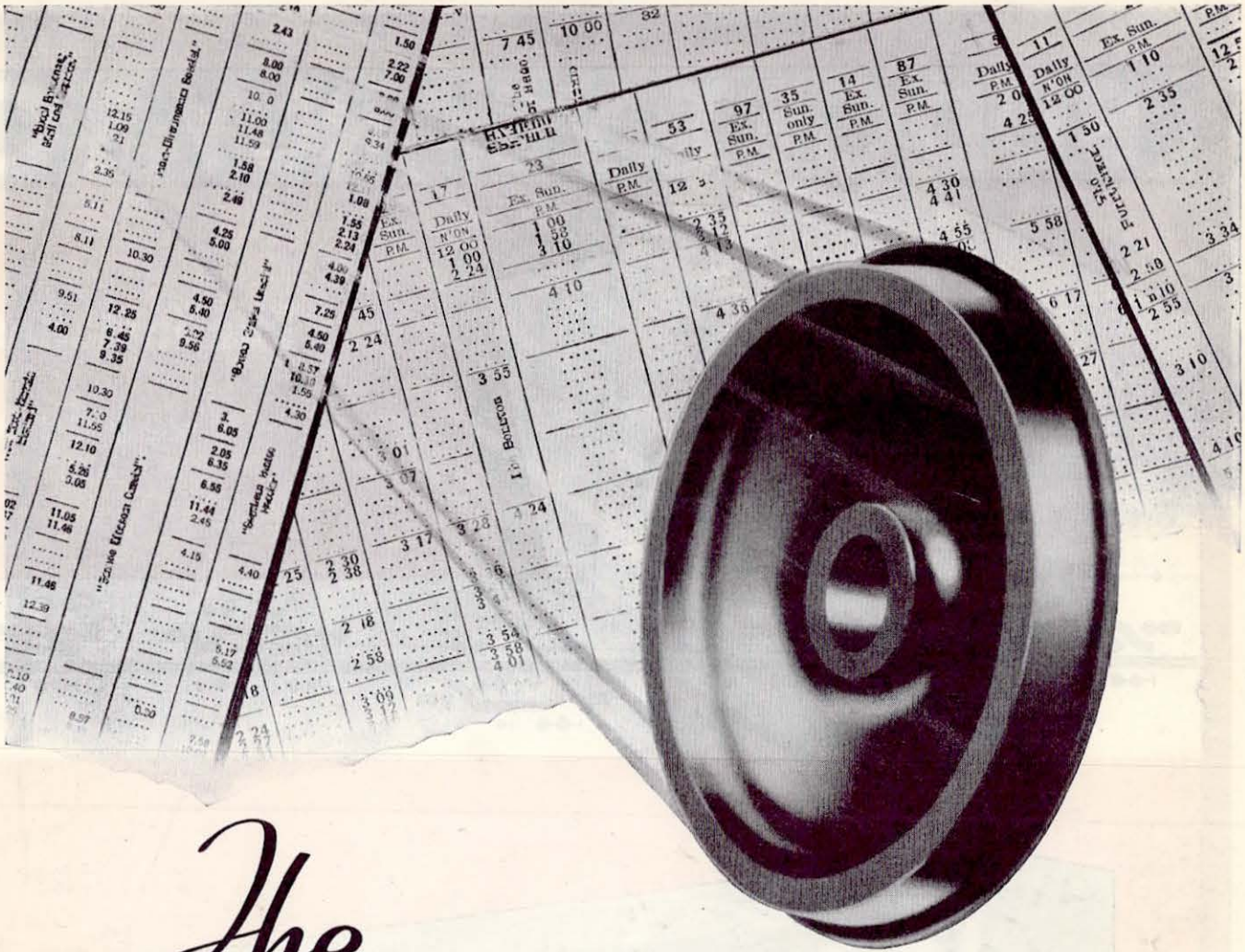
WITH

UNITCAST

THE UNITCAST CO. TOLEDO



Published weekly by Simmons-Boardman Publishing Company, 1309 Noble Street, Philadelphia, Pa. Entered as second class matter, January 4, 1933, at the Post Office at Philadelphia, Pa., under the Act of March 3, 1879.



The

HIGHEST SCHEDULED SPEEDS THAT WHEELS HAVE EVER CARRIED

FREIGHT TRAINS climb up toward former passenger-train speeds, passenger-train schedules move up to still faster levels, while new streamline equipment brings the highest scheduled speeds that wheels have ever carried.

This swifter rate of travel for all classes of traffic brings new responsibilities to wheels, demands exceptionally high resistance to the shocks encountered in running, and the wear-and-tear of violent braking action.

Bethlehem Heat-Treated Wrought-Steel Wheels have a full measure of the properties needed to meet these present-day demands. The forging and rolling processes of manufacture impart high inherent qualities of strength and endurance. The heat-treatment of the rim provides the wheel with a wear-defying coat of armor that stalls off the need for attention for many thousands of miles.

Engine trucks, tenders, passenger cars, special high-speed equipment are all set for fast running with low wheel maintenance when equipped with Bethlehem Heat-Treated Wrought-Steel Wheels.

Bethlehem District Offices are located at Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Indianapolis, Kansas City, Milwaukee, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul, Washington, Wilkes-Barre, York. *Pacific Coast Distributor:* Pacific Coast Steel Corp., San Francisco, Seattle, Los Angeles, Portland, Honolulu. *Export Distributor:* Bethlehem Steel Export Corp., New York.

BETHLEHEM STEEL

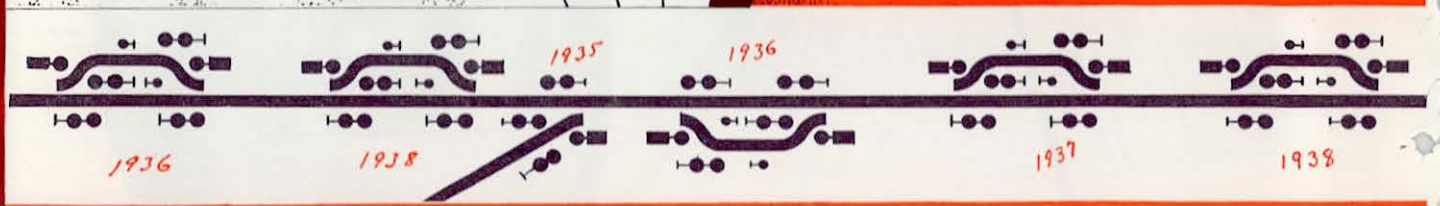
BETHLEHEM WROUGHT-STEEL WHEELS

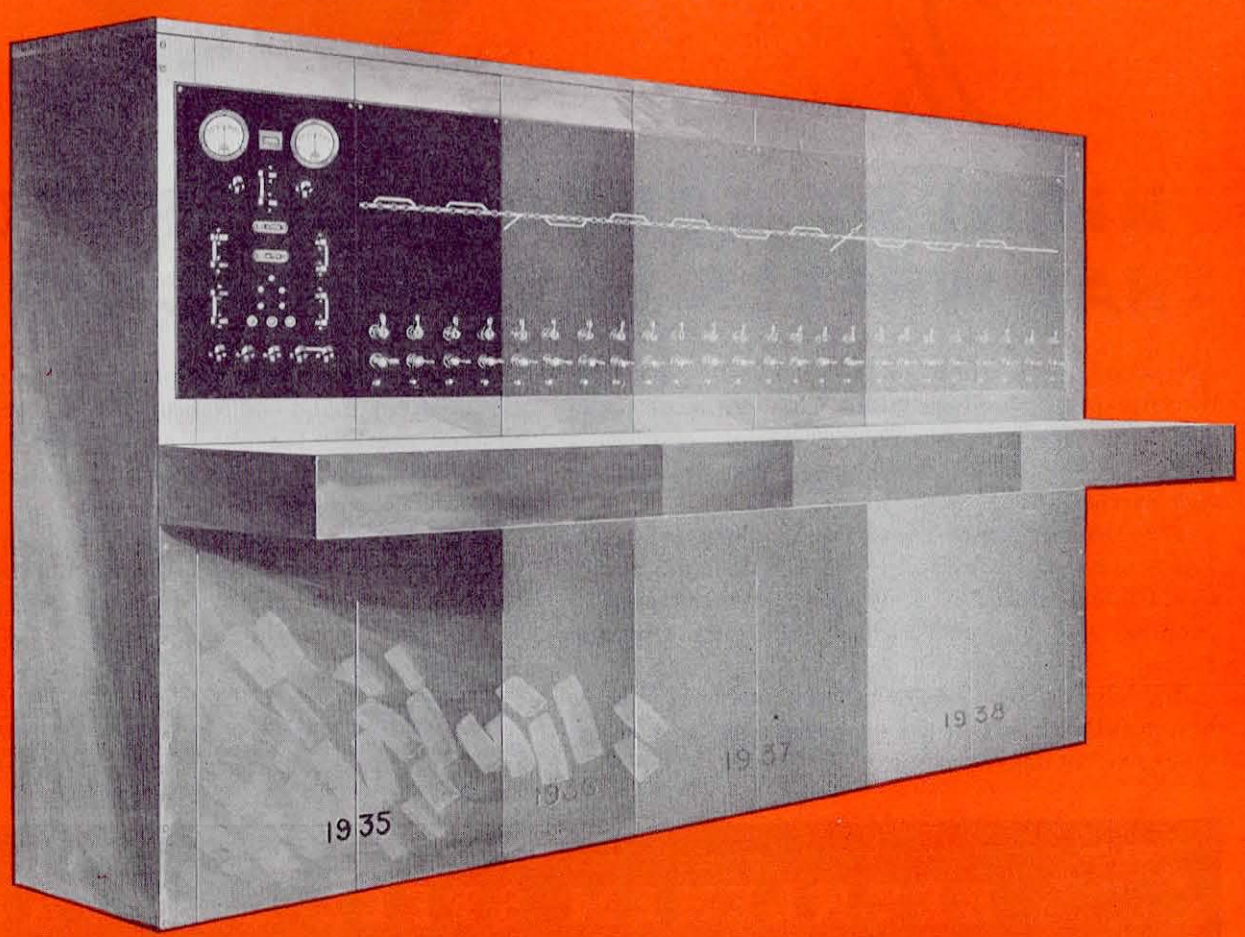
BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

BUDGET YEARLY TO

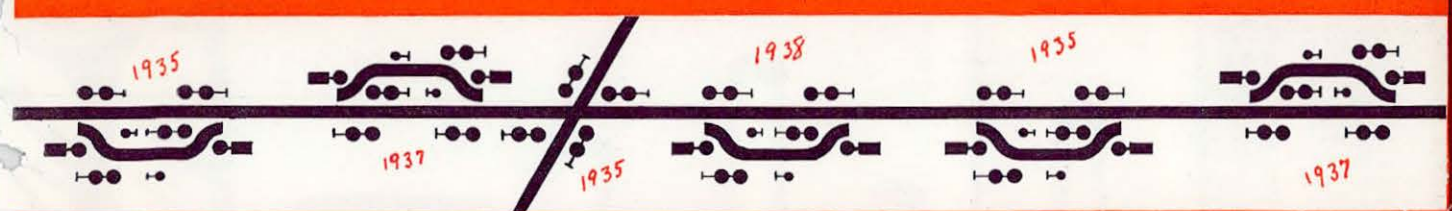
The installation yearly will





BUILD A SYSTEM

of several Coded Remote-Control Locations eventually become "cTc" over the division.



Let the signal system pay for itself during its formation. Remote Control installations show annual net returns averaging 50 per cent.

This plan is flexible. Add control when and where it is justified. One or more switches remotely controlled by our coded system added from time to time in a district will ultimately build a solid *Centralized Traffic Control Coded System.* You will then have the ultimate and desirable method of dispatching trains by signal indication and abandon the use of cumbersome train orders.

Further information on details of this plan upon request.

GENERAL RAILWAY SIGNAL COMPANY

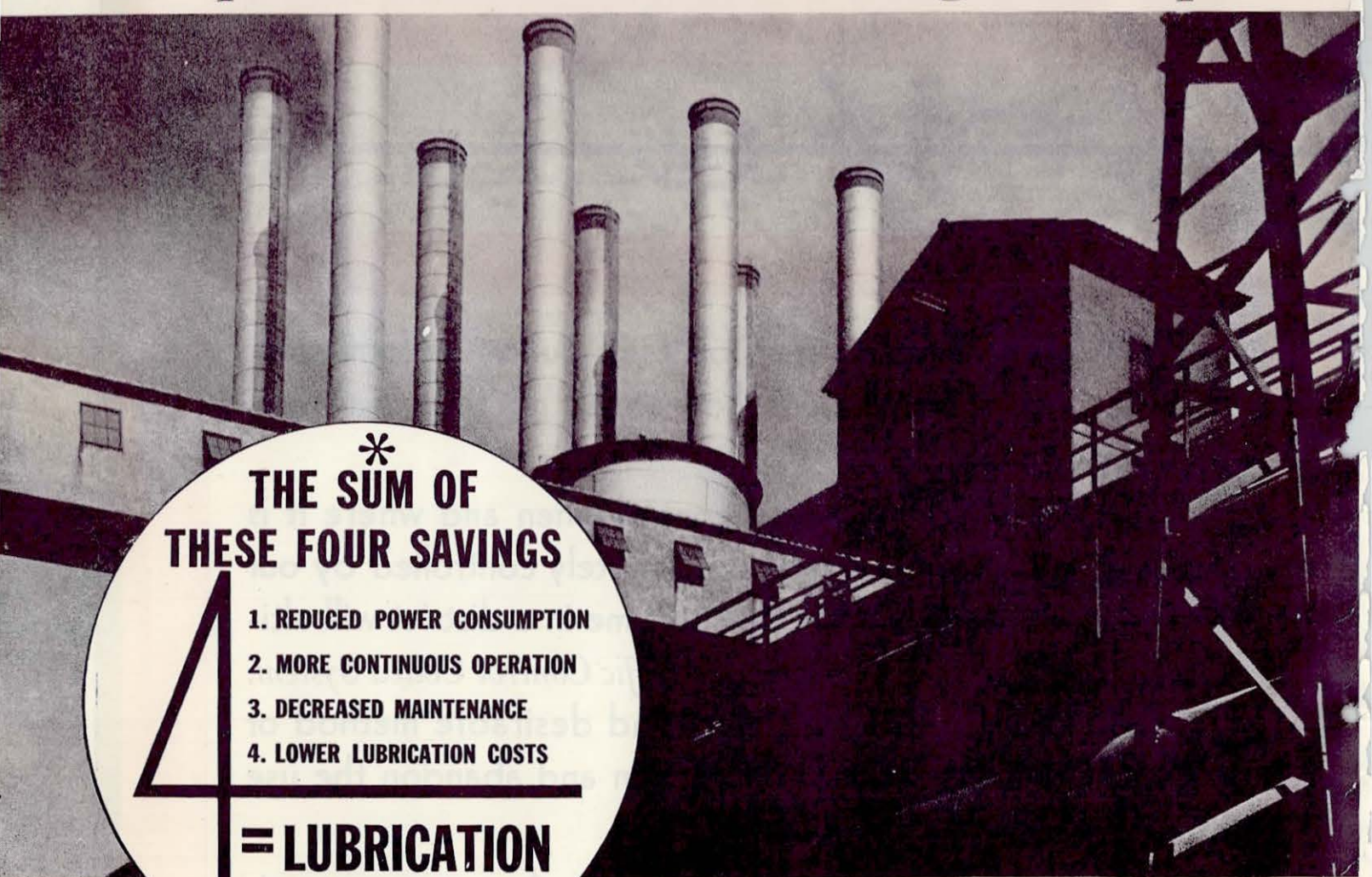
ROCHESTER, N. Y.

New York Chicago St. Louis A-1260

Montreal London Paris Tokyo Madrid Melbourne Calcutta Buenos Aires

America's Transports

..adopt an Old Manufacturing Principle*



* THE SUM OF THESE FOUR SAVINGS

4

1. REDUCED POWER CONSUMPTION
2. MORE CONTINUOUS OPERATION
3. DECREASED MAINTENANCE
4. LOWER LUBRICATION COSTS

= LUBRICATION PROFIT

THOUSANDS OF STACKS clouding the skies at Detroit attest to the motor industry's activity . . . and here too, Socony-Vacuum's LUBRICATION PROFIT plan means greater efficiency and savings as it does in railroading.

GARGOYLE Lubricants

SOCONY-VACUUM INCORP

tion Factories

IN THE SINGLE YEAR just past, Socony-Vacuum helped more than 100 American railroads find the profitable answer to their lubrication problems.

The foundation rock of this service is the well established Socony-Vacuum principle of LUBRICATION PROFIT, effecting savings through lower power cost, more continuous operation, lower repair and maintenance expense and the lowered cost of lubrication itself.

It is the same principle as that used for years by Socony-Vacuum engineers in giving similar help to some 25,000 industrial plants and more than 2,000 factories turning out industrial equipment.

Essentially the functions of industrial and railroad equipment are alike; although the factory may produce brass tacks and the railroad's product is transportation. And in running either profitably, correct lubrication is a major factor.

But because railroad operation presents highly specialized problems, Socony-Vacuum serves the railroads of America through a specialized Railway Division.

The engineers of the Division devote their entire attention to railroad lubrication; and your particular requirements are the sole basis of the Railroad Division's recommendations to your staff.

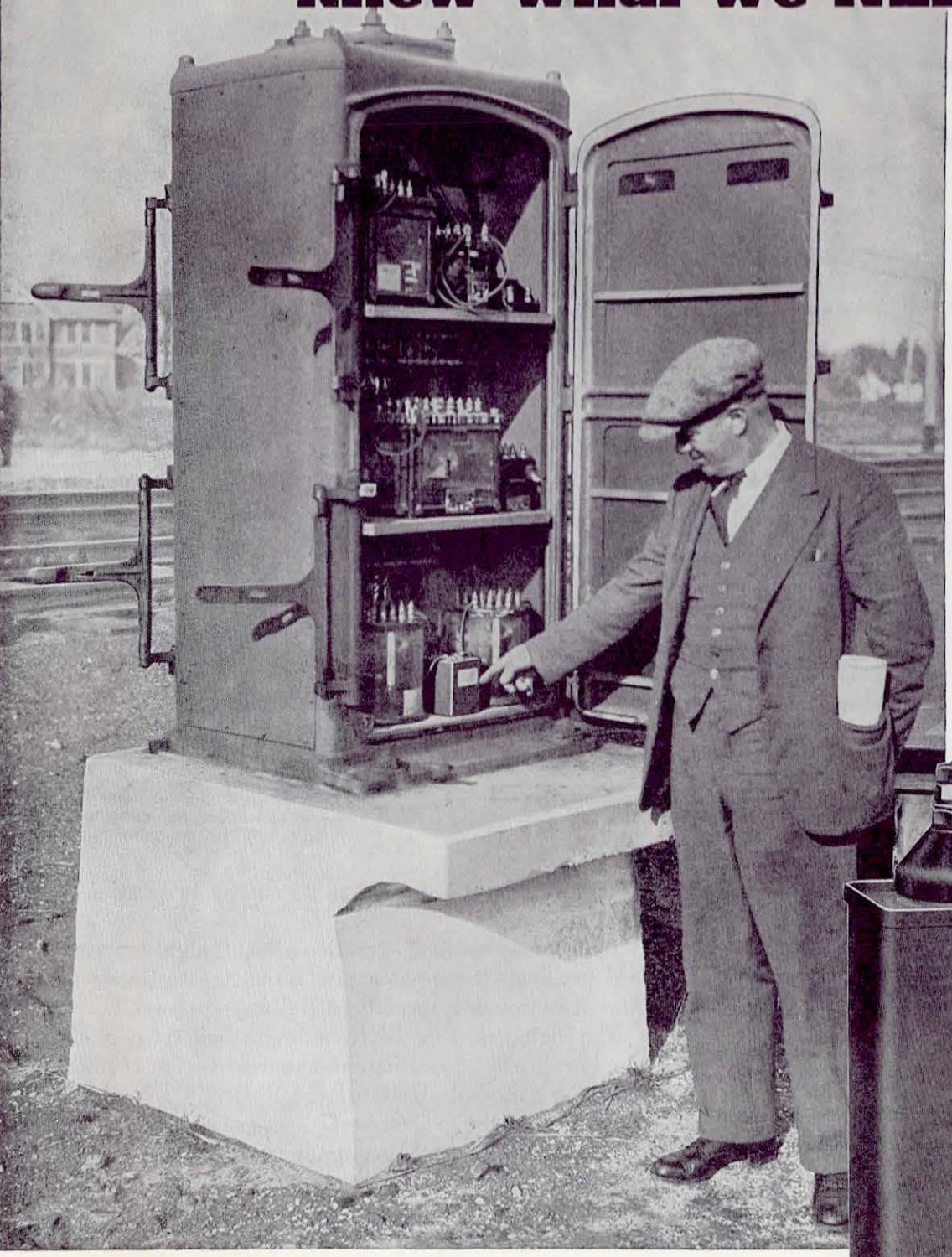
In addition, Socony-Vacuum offers a complete line of lubricants which are designed specifically to serve the requirements of all types of railroad equipment.

Address your inquiry to the Railroad Division of the Socony-Vacuum Oil Company, Inc., at 26 Broadway, New York; 59 East Van Buren St., Chicago, Ill.; or to any of the member companies which have been listed below.

OIL COMPANY
ORATED

STANDARD OIL COMPANY OF NEW YORK
WADHAMS OIL COMPANY
WHITE STAR REFINING COMPANY
LUBRITE REFINING CORPORATION
WHITE EAGLE OIL CORPORATION
MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORP. OF CALIF.

"Whoever made that capacitor knew what we NEEDED!"



The Type CE Capacitor—Pyranol Filled—Meets These Needs:

Improves operation by boosting the voltage at **every** signal location

Reduces power consumption

Installation cost is negligible

Can be mounted in any position, to utilize any available space

It is safe: highly insulated, hermetically sealed, nonexplosive, and nonflammable

Reduces load on line, making it possible to increase present loads or to extend the line

Make G. E. Your Headquarters

for Everything to GENERATE • TRANSFORM •

G E N E R A L

Yes, ALL G-E Signal Power Equipment Is Engineered to Your Needs

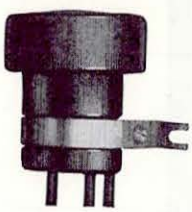
TRANSFORMERS

Many thousands of Type H oil-cooled transformers, for high-voltage power distribution and substation service, are in use in the central-station, industrial, and railway fields. They have set the highest standard of reliability and efficiency.

Designed expressly for signal service, Type TC air-cooled transformers, for medium-voltage distribution lines, supply voltage reliably and efficiently to each signal load. The weatherproof steel case is compound-filled, positively sealing the windings against moisture.

LIGHTNING ARRESTERS

Adequate lightning protection will pay for itself many times over by reducing replacement costs, preventing operating troubles, and helping to maintain reliable traffic schedules.



The G-E pellet-type arrester is recommended for protection at each high-voltage transformer location. Thousands of these arresters have proved their effectiveness in central-station and industrial, as well as railway work.

The G-E compression-chamber type of arrester is

recommended for protection on medium-voltage distribution lines not exceeding 750 volts. Like the Type TC distribution transformer, it is expressly designed for signal service.

The G-E signal arrester is expressly designed for the protection of low-voltage signal circuits. It was developed in the world's largest high-voltage laboratory by engineers who, as the result of years of specialized experience, appreciate the practical significance of lightning protection. The Thyrite gap unit is removable to facilitate testing.

FUSE CUTOUTS

Easy to spot and easy to fuse! This new G-E porcelain-enclosed cutout, for high-voltage power lines, gives unmistakable indication in case the fuse is blown. Other valuable features are safety, ease of fuse renewal, positive operation, and a strong, adjustable, inexpensive mounting.

WIRE AND CABLE

For many years, G.E. has furnished wire and cable in accordance with A.R.A. Signal Section specifications. In addition, our engineers have developed, expressly for signal service, a rubber-compound covered wire having much higher insulation resistance and considerably longer life. We can meet your wire and cable needs.

PORTABLE INSTRUMENTS

You'll find many profitable uses for these handy instruments. Compact, they can easily be slipped in a coat pocket. Moreover, they are unusually accurate for their size, and so sturdy that they will stand a lot of rough usage without loss of accuracy. They will give you years of good service.

AUTOMATIC SUBSTATIONS

General Electric furnished the first automatic substation for railway-signal service, and many of the automatic train-control systems in

service today rely on G-E automatic substations for their power supply. General Electric is prepared to design and build automatic substations of the utmost efficiency and reliability, co-ordinating the most advanced designs of transformers, motor-generator sets, frequency converters, switchgear, control, and protective equipment available to the industry.

General Electric, Schenectady, N. Y.

CONTROL • PROTECT • Your Signal Power

96-117

E L E C T R I C

DOUBLE the HEATING the WELDING CAPACITY

of your AIRCO-DB Welding Torch

with the new

AIRCO-DB TWO-FLAME TIP

● *Two torches in one*—that's what it amounts to when you screw this TWO-FLAME TIP to the handle of the regular AIRCO-DB Welding Torch. By providing double the amount of heat, the temperatures required in building up rail ends and in heat treating, are reached much faster and with less dissipation of heat through the rail. Obviously this means a saving of gases and material as well as time. Use the AIRCO-DB TWO-FLAME TIP and cut the cost of your rail end welding and heat treating. WRITE for details.

NRA MEMBER U.S. WE DO OUR PART

AIR REDUCTION SALES CO.

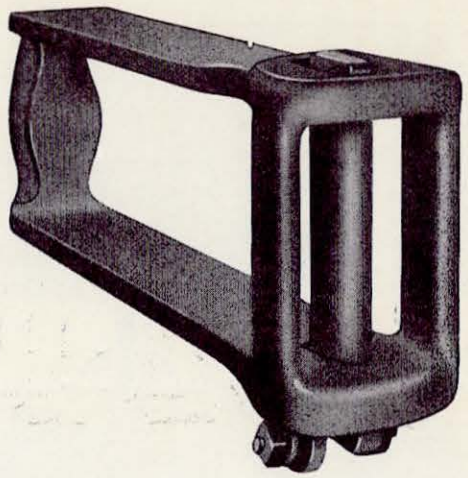
General Offices: 60 East 42nd St., New York, N. Y.

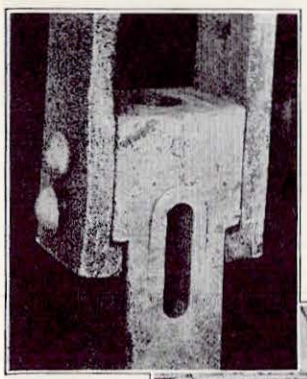
DISTRICT OFFICES and DISTRIBUTING STATIONS IN PRINCIPAL CITIES

A NATION-WIDE WELDING and CUTTING SUPPLY SERVICE

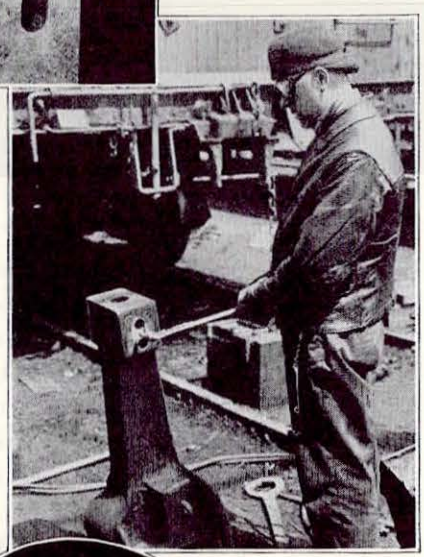
JANNEY

VERTICAL CAST STEEL COUPLER YOKE

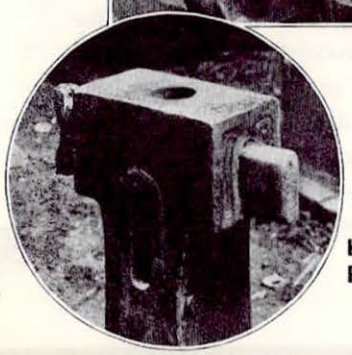




LOOSE RIVETS



BURNING OUT BRIDGE



KEY IN PLACE

Thousands of wrought riveted yokes previously applied to freight equipment of the American Railroads have been replaced with Janney Yokes, eliminating the heavy maintenance expense arising from loose yoke rivets.

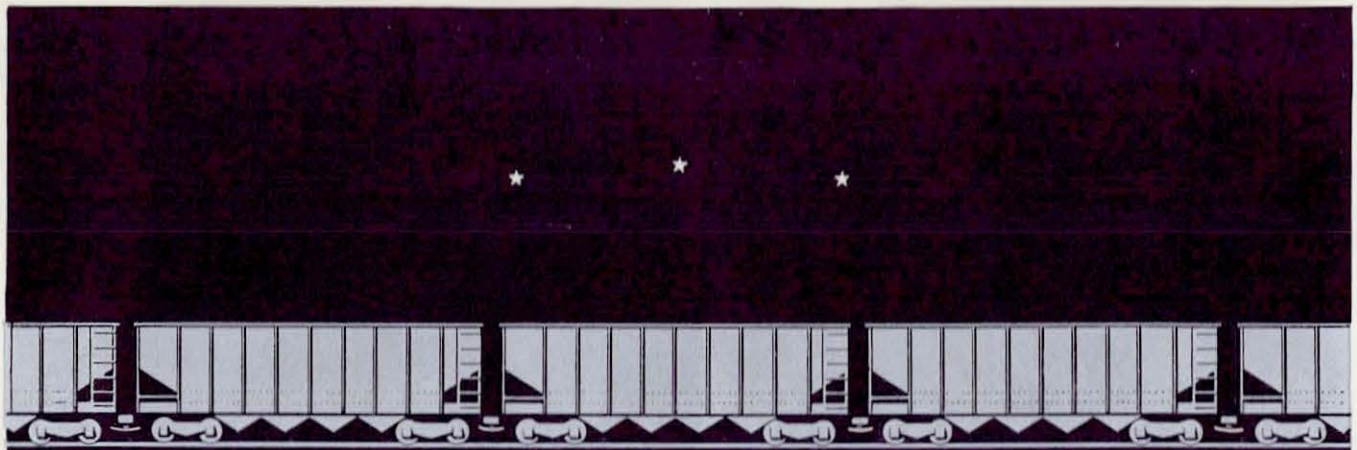
When a wrought yoke is replaced with a Janney Vertical Yoke, the original coupler is again used, the bridge of metal between the rivet holes in the butt being burnt out to form the Janney key slot.

The heavy vertical forged steel key used with the Janney Yoke fits into the slot formed when the bridge between the rivet holes of the coupler shank is burnt out, and is the dependable connection between the coupler and yoke.

The Janney Vertical Key Yoke permits quick and easy changing of couplers.

AMERICAN STEEL FOUNDRIES

NEW YORK CHICAGO ST. LOUIS



WEIGHT SAVED WITH ALUMINUM

HELPS NET OPERATING REVENUE THREE WAYS

ALCOA

Construction of rolling stock of the strong alloys of Alcoa Aluminum has three direct, positive results on Net Operating Revenue.

Freight revenue per car is increased. Depending on the size of car and the extent to which Aluminum is used, weight savings of from 3 to 8 tons per car are attained. Those savings in dead weight add to revenue load capacity.

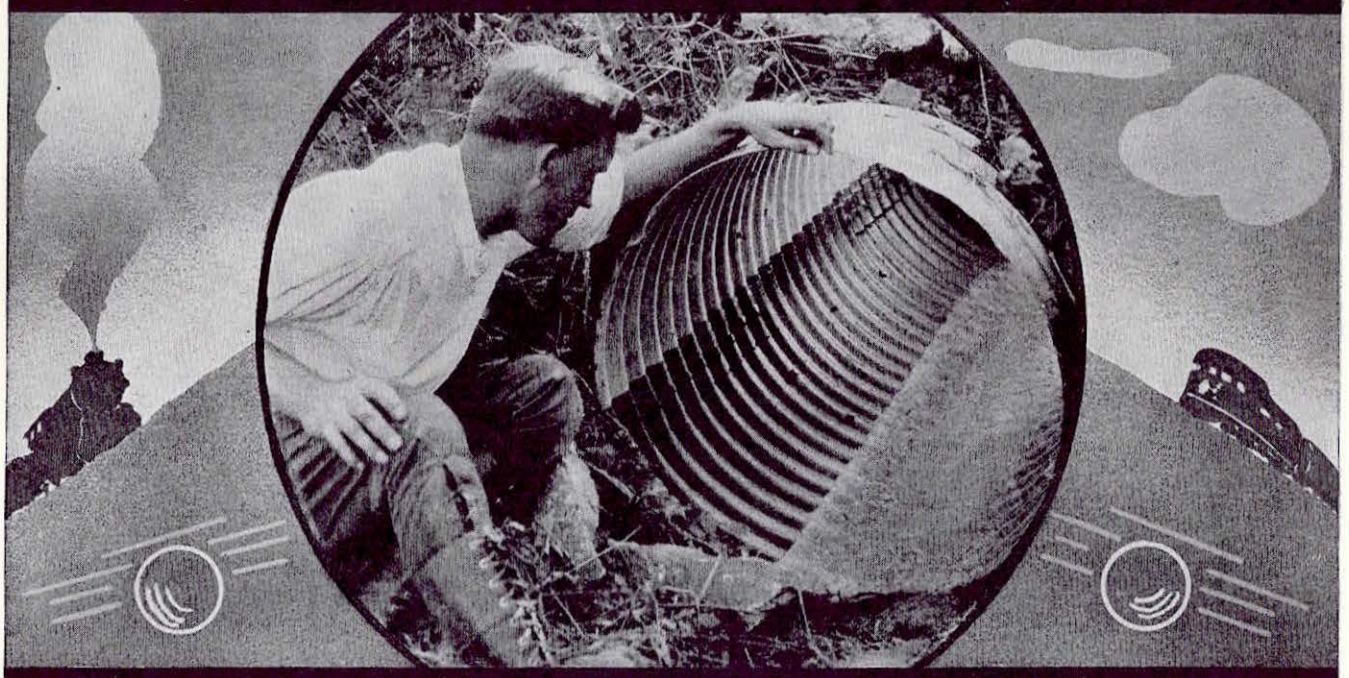
Operating expense is decreased. Multiply the weight saved per car by the annual empty mileage to get the annual ton-mile savings in haulage cost.

Maintenance expense is decreased. Alcoa Aluminum is highly resistant to the kinds of corrosion (atmospheric and sulphur) most prevalent in railroad operation. And Aluminum rolling stock stands the gaff of service because the light shapes and light plates have the thickness and consequently the stiffness that the severity of the service demands.

These three points are the basis for the increasing recognition of the sound economics and sound engineering that derive from rolling stock construction of Alcoa Aluminum. For complete facts and figures, address ALUMINUM COMPANY OF AMERICA, 1878 Gulf Building, Pittsburgh, Pa.

ALCOA ALUMINUM

MAKE SERVICE CONDITIONS YOUR GUIDE



IN SELECTING CULVERTS AND DRAINS

RAILWAY engineers and operating officials agree that *service conditions vary.* That's why it is so important to choose the type of culvert or drain, which is best suited to the individual conditions and requirements of each job.

To simplify your problem, Armco offers you a "balanced drainage" plan—with a correctly designed product for each size and type of installation. 29 years of experience prove that this plan insures dependable drainage at the *lowest cost per year.* See your local Armco engineer, or write

INGOT IRON RAILWAY PRODUCTS CO.
Middletown, Ohio Berkeley, California
(Member of the Armco Culvert Mfrs. Assn.)
Philadelphia . St. Louis . Salt Lake City . Los Angeles
Minneapolis . Houston . Portland . Atlanta . Denver
Chicago . Dallas . El Paso . Spokane

ARMCO'S "BALANCED DRAINAGE" PLAN

FOR PIPE UNDER TRACK

	Type of Installation	Recommended Armco Products
1	Small and medium-size openings. (8 to 60 in.)	Paved Invert Pipe
2	Bridges and Large Culverts	MULTI PLATE (Pipe or Arches)
3	Subdrains	Perforated Pipe (with Paved Invert)

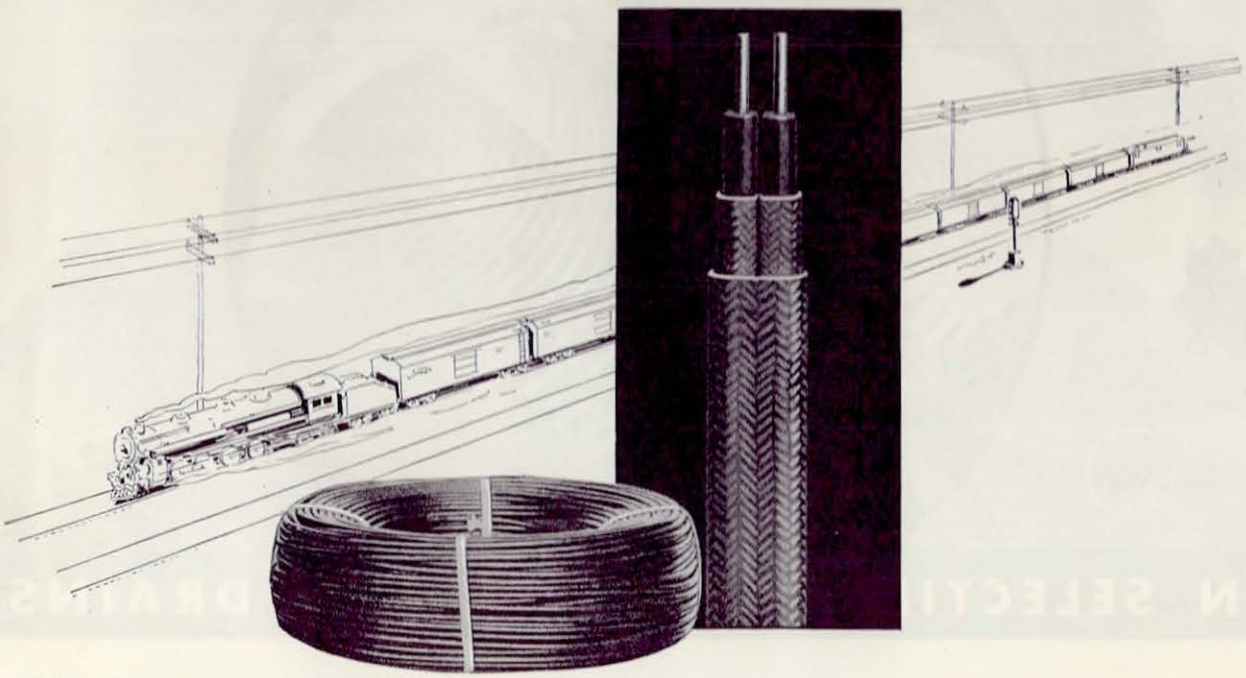
FOR PIPE NOT UNDER TRACK

	Type of Installation	Recommended Armco Products
1	Small and medium-size openings	
	a. Normal Conditions	Unpaved Corrugated Pipe
	b. For Steep Grades	Paved Invert Pipe
	c. Continuous Flow	Paved Invert Pipe
	d. Under High Fills	Paved Invert Pipe
	e. Diameters larger than 24 inches	Paved Invert Pipe
2	Bridges and Large Drains	MULTI PLATE (Pipe or Arches)
3	Subdrains	Perforated Pipe

ARMCO

CORRECTLY DESIGNED DRAINAGE PRODUCTS
★ **for every service condition** ★

WHERE DEPENDABILITY.. IS ESSENTIAL



You can DEPEND *on this "wire knowledge"*

UNDER no conditions of service is dependability so vitally essential—as in the operation of signal and other circuits. And—from no other source can you secure such consistent perfection in electrical wires and cables—such assurance of unvarying performance—and such a wealth of experience with installations in the railway field. Our engineers will gladly cooperate with you—and you are invited to take full advantage of their "wire knowledge."

Perfected Telephone, Telegraph Wire and Strand, Tie Wires, Bond Wires, Rubber Covered Wires, Signal Wires, Aerial Cables, Locomotive Headlight Wires, Parkway Cables, Weatherproof Wires, Bare Copper Wires, Trolley Wires, Signal Bonds and Power Bonds.

For Perfect Right-of-Way Protection Use
AMERICAN RAILROAD FENCE · BANNER STEEL LINE POSTS
NATIONAL EXPANDING ANCHOR DIRT SET END AND CORNER POSTS
and AMERICAN STEEL GATES

AMERICAN STEEL & WIRE COMPANY

208 SOUTH LA SALLE STREET · · CHICAGO

Offices in All Principal Cities

United States Steel Corporation Subsidiary

USS Forever New

AGE holds no terrors for equipment fabricated from USS Stainless and Heat-Resisting Steels. Decades of exposure cannot rust or mar the shimmering surface nor the utility of this ageless metal.

For any application in which you want beauty to endure, specify USS Stainless Steel. There is a type suited to your needs . . . in resistance to specific corroding agents and in the physical qualities which you need. Our representatives will be glad to cooperate with you in the determination of the right Stainless Steel for your requirements.

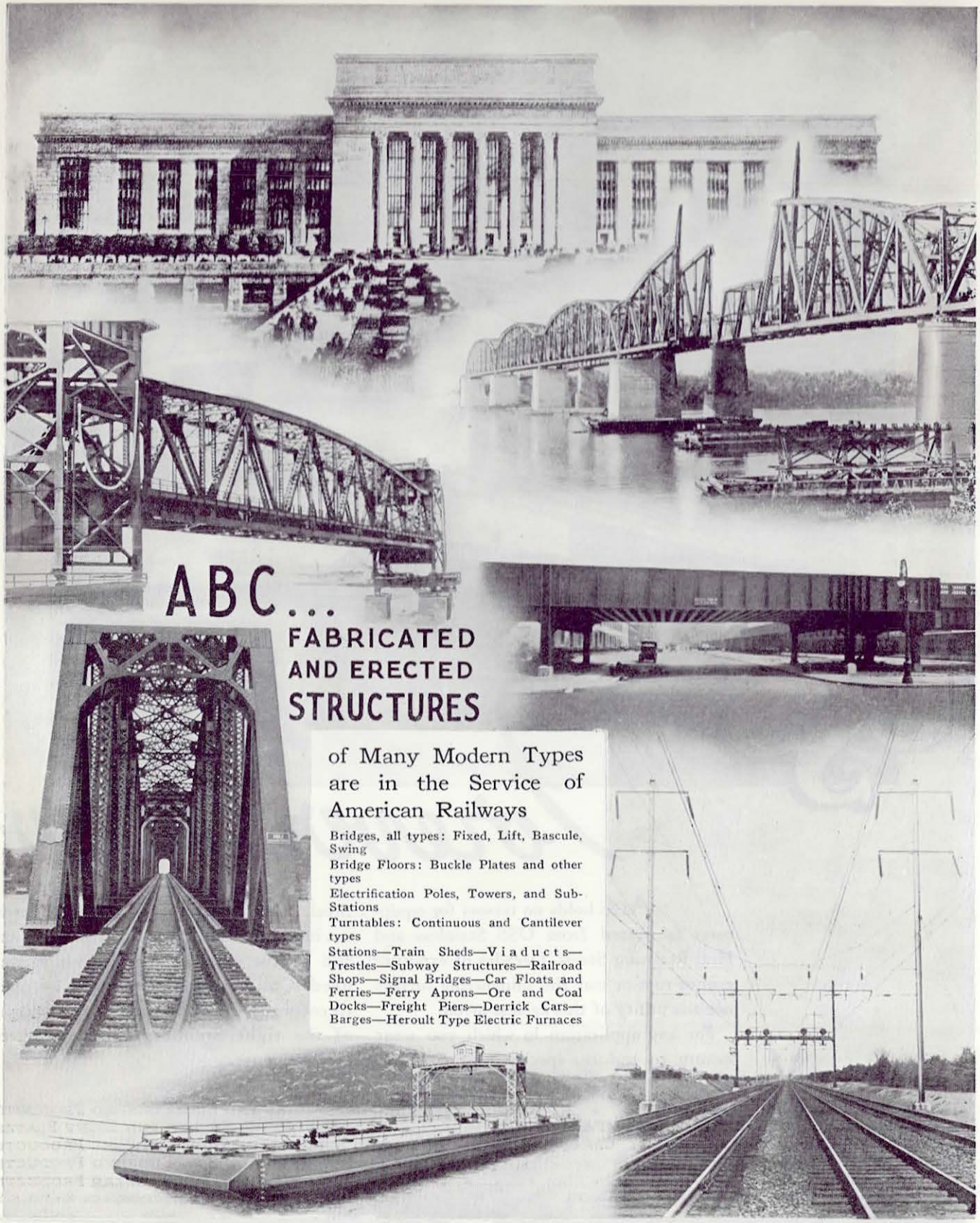
ILLINOIS STEEL COMPANY, *Chicago* - - - BARS, PLATES, SHAPES, SPECIAL AND SEMI-FINISHED PRODUCTS
AMERICAN SHEET AND TIN PLATE COMPANY, *Pittsburgh* - - - - - - - - - SHEETS AND LIGHT PLATES
AMERICAN STEEL & WIRE COMPANY, *Chicago* - - COLD ROLLED STRIP STEEL, WIRE AND WIRE PRODUCTS
CARNEGIE STEEL COMPANY, *Pittsburgh* - - - - - SHAPES, PLATES, BARS AND SEMI-FINISHED PRODUCTS
NATIONAL TUBE COMPANY, *Pittsburgh* - - - - - - - - - - - - - - PIPE AND TUBULAR PRODUCTS

Pacific Coast Distributors—COLUMBIA STEEL COMPANY, San Francisco, Calif. *Export Distributors*—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiaries

USS STAINLESS AND HEAT RESISTING STEELS

USS CHROMIUM-NICKEL ALLOY STEELS ARE PRODUCED UNDER LICENSES OF THE CHEMICAL FOUNDATION, INC., NEW YORK, AND FRIED. KRUPP A. G. OF GERMANY



ABC... FABRICATED AND ERECTED STRUCTURES

of Many Modern Types are in the Service of American Railways

Bridges, all types: Fixed, Lift, Bascule, Swing
Bridge Floors: Buckle Plates and other types
Electrification Poles, Towers, and Sub-Stations
Turntables: Continuous and Cantilever types
Stations—Train Sheds—Viaducts—Trestles—Subway Structures—Railroad Shops—Signal Bridges—Car Floats and Ferries—Ferry Aprons—Ore and Coal Docks—Freight Piers—Derrick Cars—Barges—Heroult Type Electric Furnaces

AMERICAN BRIDGE COMPANY

GENERAL OFFICES: *FRICK BUILDING • PITTSBURGH, PA.*

Baltimore Boston Chicago Cincinnati Cleveland Denver Detroit Duluth Minneapolis New York Philadelphia St. Louis Salt Lake City

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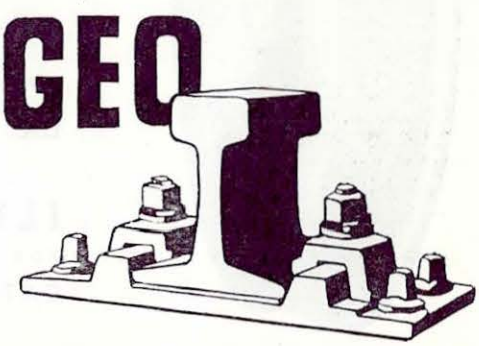
United States Steel Corporation Subsidiary

we would regulate our speed accordingly. To safely and comfortably utilize the potential power of modern motor cars, we must have modern highways.

Railroad transportation presents a parallel case. The new 100-mile-an-hour trains need 100-mile-an-hour track. Fortunately, such track is available. It has convincingly demonstrated its safety, its smooth-riding qualities, its accurate alignment and its low maintenance costs under high speed traffic. It is GEO.



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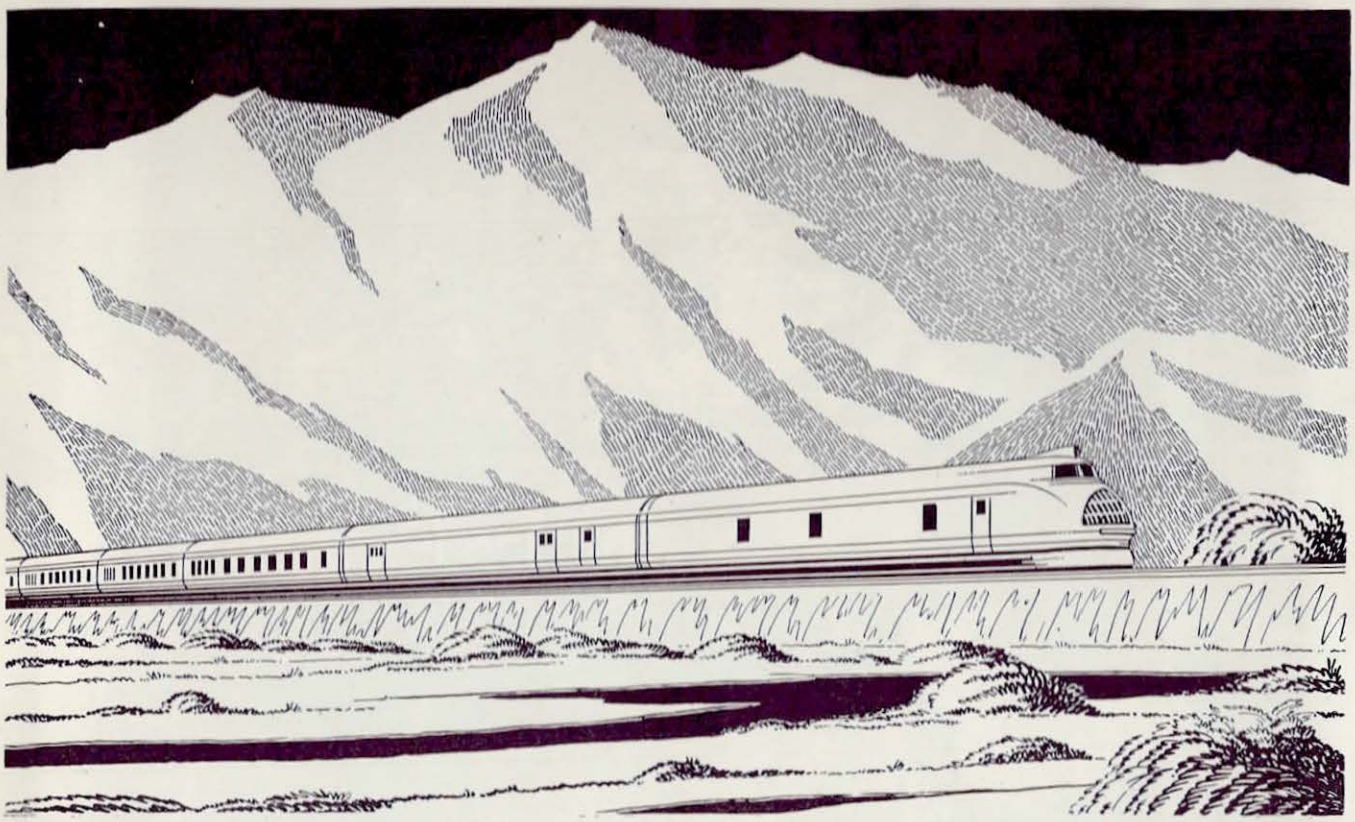
CARNEGIE STEEL COMPANY • THE LORAIN STEEL COMPANY

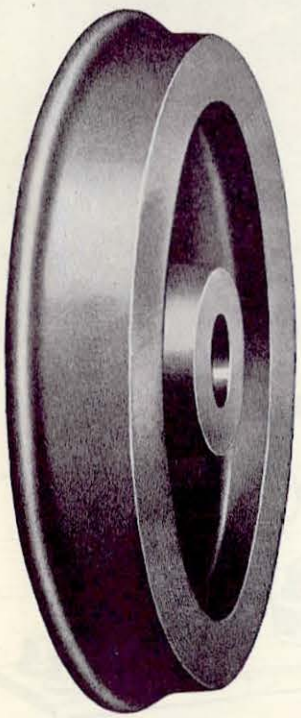
PITTSBURGH • PA. JOHNSTOWN • PA.

United States Steel Corporation Subsidiaries



ILLINOIS WROUGHT STEEL WHEELS

on the streamlined train of the UNION PACIFIC — THE OVERLAND ROUTE

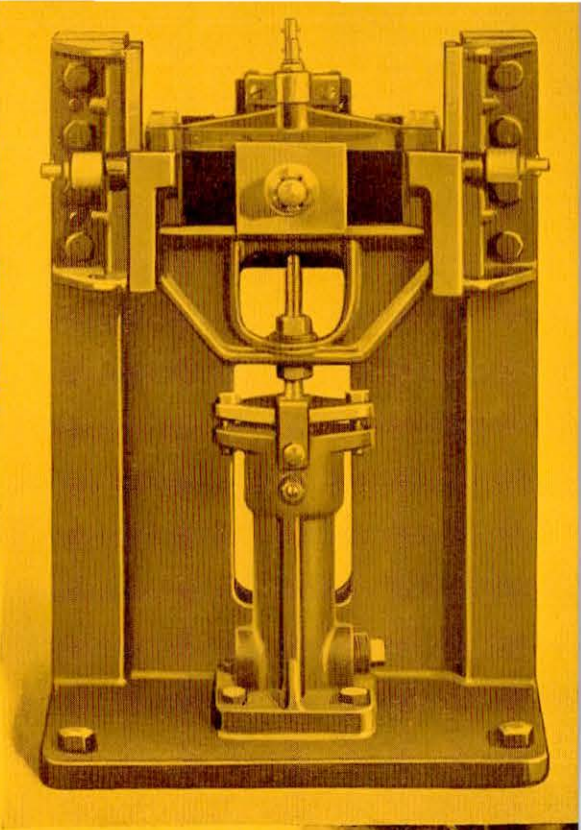


SAFETY *FOR HIGH SPEEDS*

● Plus the endurance needed to stand up under the stress of present day schedules. Dependability is wrought into Illinois Wheels by carefully controlled rolling and forging. You'll find them on much of the nation's most notable modern rolling stock.

ILLINOIS STEEL COMPANY
208 SOUTH LA SALLE STREET, CHICAGO, ILLINOIS
CARNEGIE STEEL COMPANY, PITTSBURGH

United States Steel (US STEEL) *Corporation Subsidiaries*

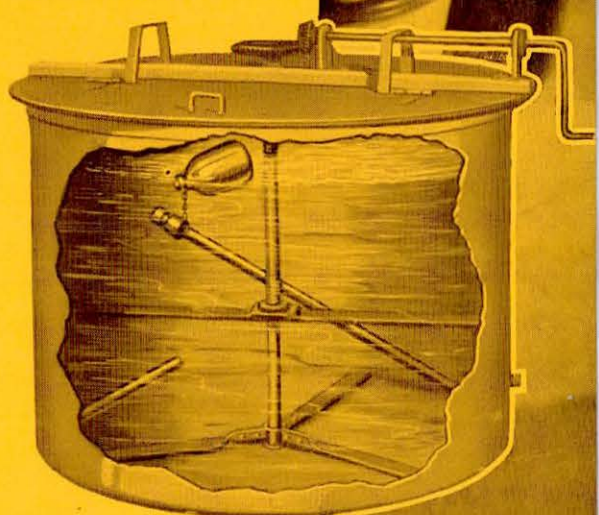


"A Pump without a Weakness"

The Dearborn Chemical Pump (pat. appl. for) combines improved features in design, adjustment and operation for pumping exact quantities of Dearborn Treatment into water supplies, and is a valuable addition to equipment available for this purpose.

The new pump has been designed by the Dearborn Engineering Department for extended periods of service without maintenance or replacements.

In this pump the ball bearings are centered, the plunger guided. There is no lost motion. Action is smooth and steady. Air pocketing is eliminated. Plungers and cylinders are interchangeable from ½ inch to 3 inches diameter. Lubrication and bearings are the latest type. The pump is easily understood and is adjusted with ordinary tools. It is operated by any actuating device. Made strongly of nickel semi-steel with special alloy plungers. Height 23½ inches. Weight approximately 125 lbs.



A Dearborn Chemical Mixing Vat, capacities 280 to 1500 gallons, illustrated below, and the Dearborn Chemical Pump make a complete treating plant unit.

Our Service Engineers will be glad to work with you in adapting these highly efficient and economical Treating Plants for your use in the application of Dearborn Treatment. Consultation invited.

●

NO-OX-ID prevents rust throughout railway service. Ask about savings under the NO-OX-ID Plan for Bridge Maintenance.

●

DEARBORN CHEMICAL COMPANY

310 S. MICHIGAN AVE., CHICAGO — 205 EAST 42nd ST., NEW YORK

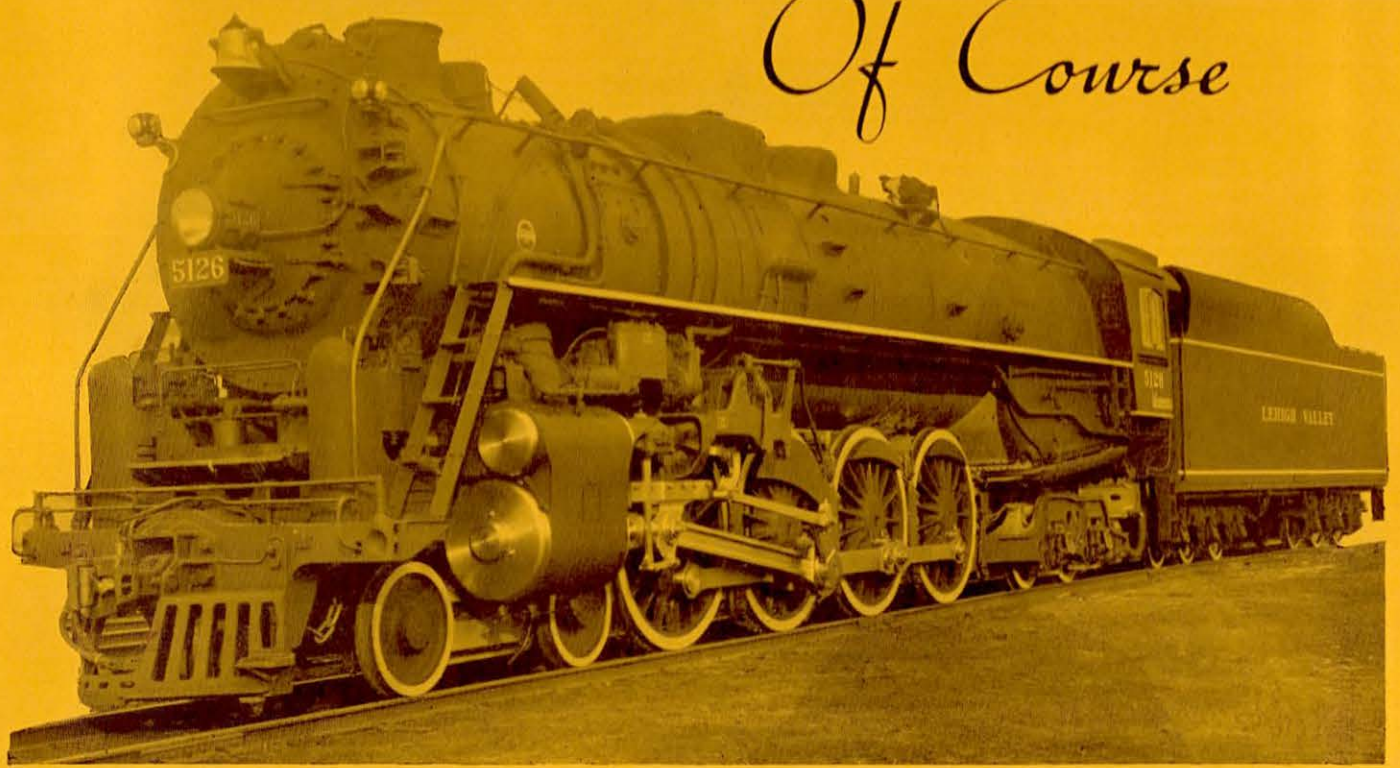
CANADIAN OFFICE and FACTORY, TORONTO

Dearborn

TRADE MARK REGISTERED

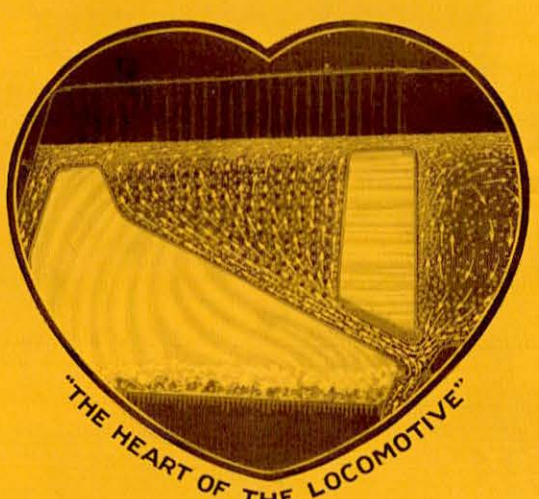
SYPHON EQUIPPED

Of Course



Including the 5 locomotives 4-8-4 type now being delivered, the Lehigh Valley R. R. Co. have 27 locomotives of this type. All are equipped with three Syphons in the Firebox and one Syphon in the Combustion Chamber. Syphons add 143 sq. ft. of most effective heating surface to the Firebox and Combustion Chamber.

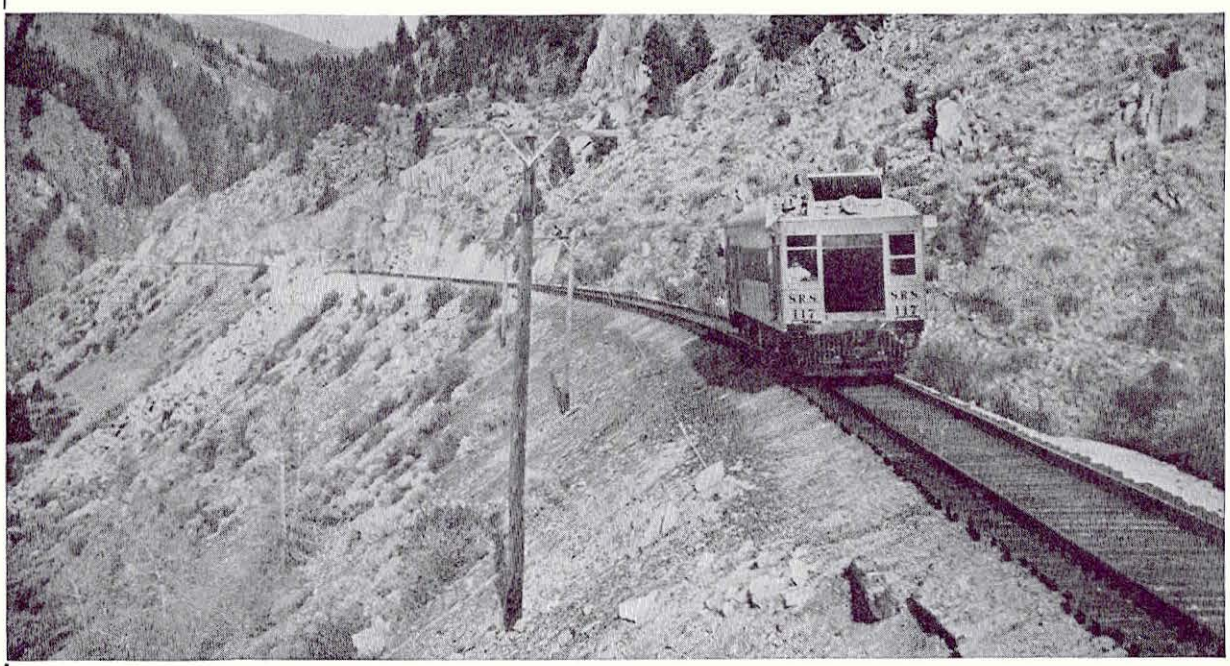
Increased Heating Surface
Increased Circulation
Improved Performance
Reduced Maintenance
Fuel Economy
Safety in Case of Low Water



LOCOMOTIVE FIREBOX COMPANY

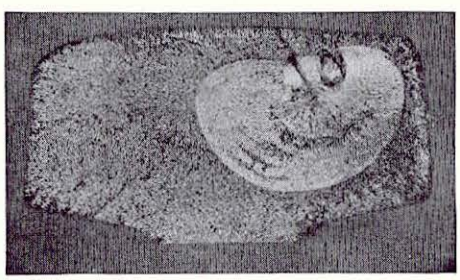
NEW YORK **CHICAGO** **MONTREAL**

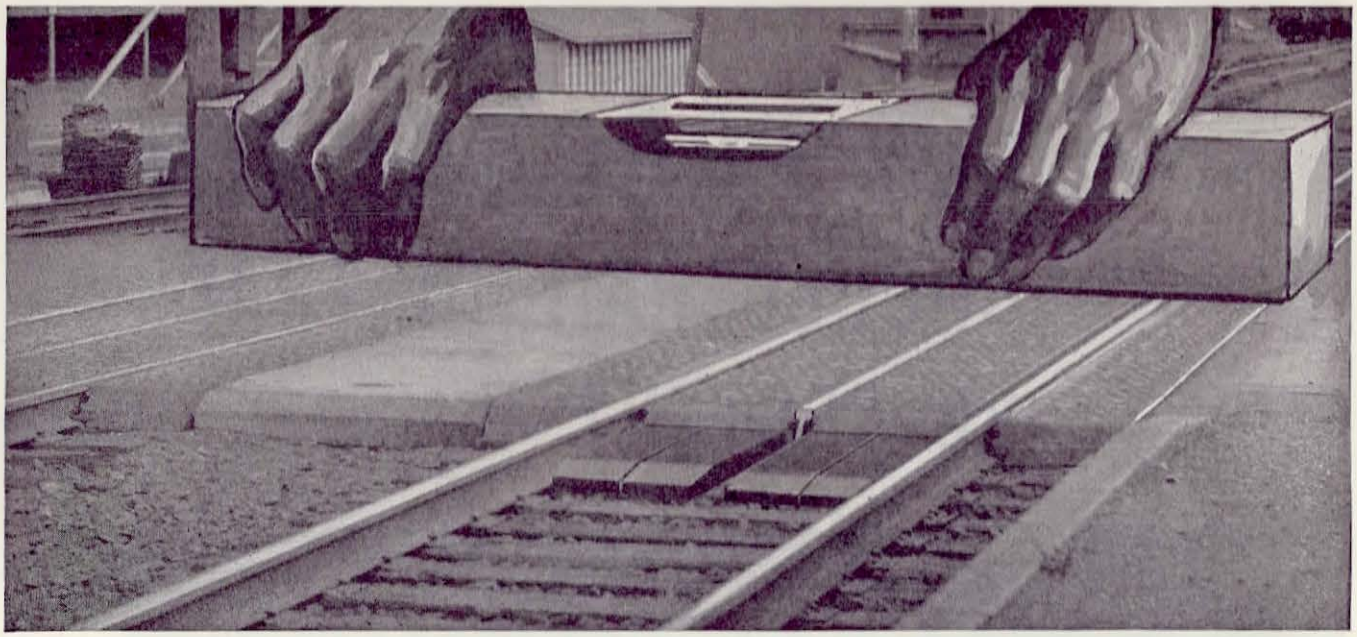
HOW FREQUENTLY SHOULD RAIL IN TRACK BE TESTED?



"AT LEAST once a year" is the majority opinion of railroads in the United States and Canada. This is confirmed by the fact that 95% of the mileage tested by Sperry during 1934 was *repeat business!* By testing periodically with Sperry, railroads find they can determine that time interval between tests which assures maximum Safety. The economy of testing with Sperry is demonstrated by the reduction in cost to railroads per transverse fissured rail found from $152 in 1930 to $46 in 1934—clear proof of the greater accuracy of Sperry Detector Cars.

SUDDEN GROWTH On the right is 32% fissure that grew from a very small size in thirty days. Because of the possibility of sudden growth, especially in certain heats and rollings, the need for maximum accuracy in testing is vitally necessary. Test with *modern* equipment! Sperry Rail Service, Inc., Brooklyn, N. Y., Chicago, Ill. (Sperry, S. A., Paris, France.)





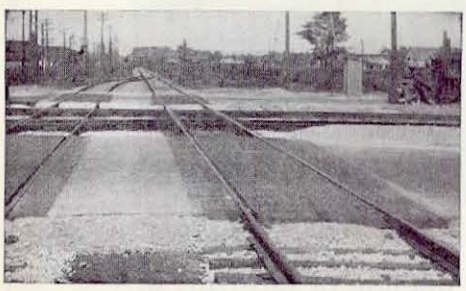
Here's a crossing that will stay put

NRA MEMBER U.S.
CODE
RAILROAD SPECIAL TRACK EQUIPMENT MANUFACTURING

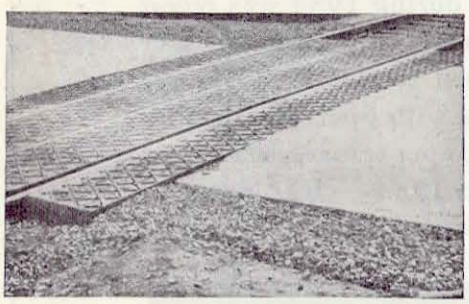
— at track level

Three features distinguish

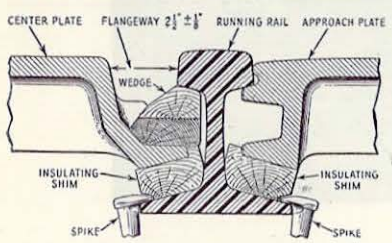
RACOR UNIVERSAL PERMANENT HIGHWAY CROSSINGS



Detroit Terminal R. R. Co., Oakland Blvd., near Grand River Ave., Detroit, Mich.



Rock Island, Ponca City, Oklahoma.



Section at running rail

1st.—They stay PERMANENTLY at track level, because the plates are supported by the BASE OF THE RAILS and therefore always follow the rail level.

2nd.—They are indestructible, more so than high test manhole covers, and will stand up for over twenty years under any traffic allowed on public roads. The individual plates are easily handled, easily installed or removed. They are toe checked on top to prevent skidding and heavily ribbed on the underside for *strength*. No special track preparation needed to put down.

3rd.—A metal non-skid highway with effective insulation between the R. R. running rails.

In short, the hundreds of crossings equipped with these plates prove beyond question that the original installation is practically the LAST COST, in spite of heaviest traffic, frost or other elements that play havoc with less permanent forms of construction.

Why not visit an installation near you? That's the BEST PROOF. Write us — and we'll be glad to advise location.

RACOR TRADE MARK

RAMAPO AJAX CORPORATION

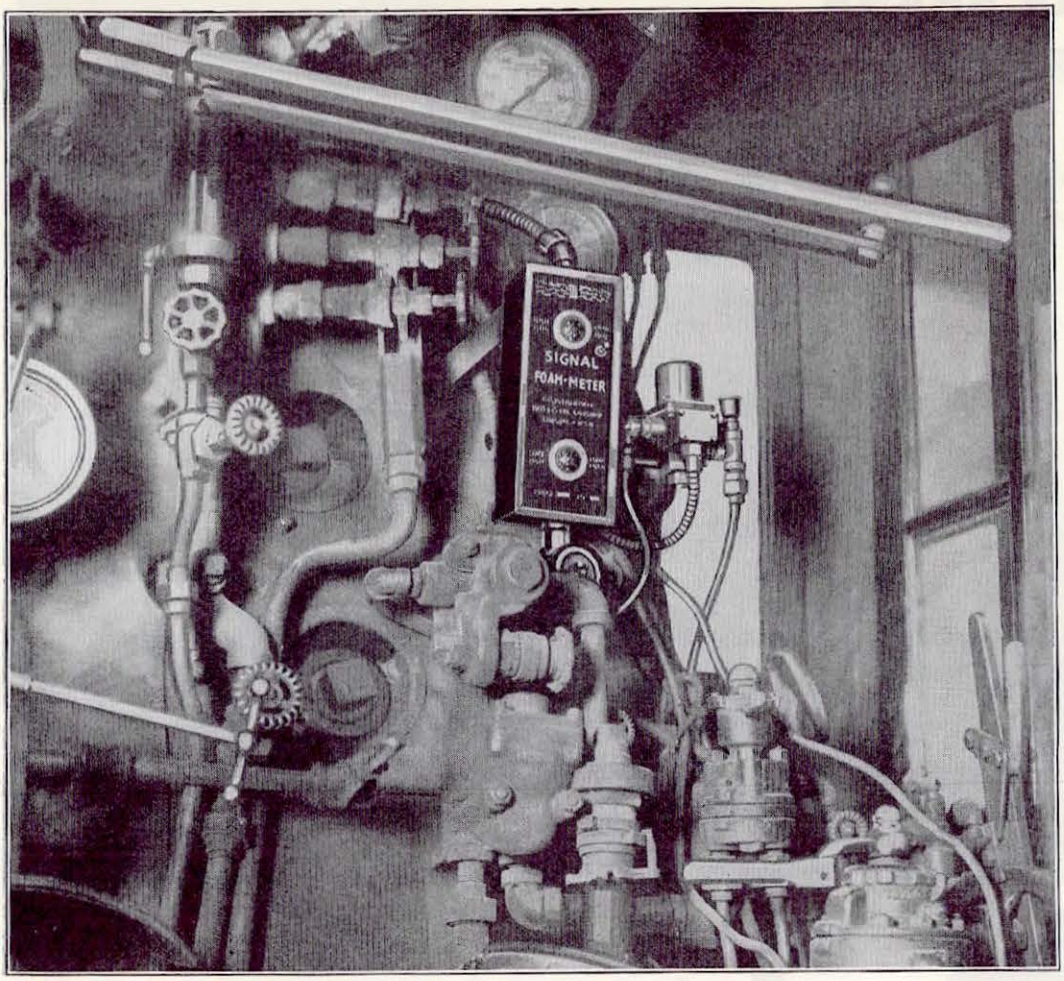
RACOR PACIFIC FROG AND SWITCH COMPANY, Los Angeles-Seattle
CANADIAN RAMAPO IRON WORKS, Limited, Niagara Falls, Ontario

General Offices — 230 PARK AVENUE, NEW YORK

SALES OFFICES AT ALL WORKS, ALSO
CHICAGO—WASHINGTON—CLEVELAND—ST. PAUL—HOUSTON
HAVANA—MEXICO CITY—BUENOS AIRES
SAN JUAN, P. R.—SHANGHAI, CHINA

Nine Racor Works
Hillburn, New York, Niagara Falls, N. Y. Chicago, Illinois, East St. Louis, Ill. Superior, Wis. Pueblo, Col. Los Angeles, Cal. Seattle, Wash. Niagara Falls, Ont.

SIGNAL FOAM METER . . . SOLVES THE OLDEST PROBLEM IN LOCOMOTIVE OPERATION



SCIENTIFIC FOAM PREVENTION

a NEW economy in locomotive operation

THE Signal Foam Meter, with Electromatic Blow-off feature, gives perfect visual indication of foam formation *within* the boiler and automatically blows down sufficiently to entirely prevent foaming—yet does not blow too much. This scientific foam control automatically takes into account every foam-producing factor, replaces guessing with scientific accuracy, and is thoroughly practical and *continuously effective.*

Exact and automatic blow-off when required (and never unless required), increases the period between wash-outs, reduces terminal costs, makes an important contribution to safety of operation, and increases locomotive revenue mileage. *It saves fuel and water,* and permits full chemical treatment for complete scale prevention.

Experience on leading roads now using the Signal Foam Meter has shown as much as 200% return on the investment from fuel and water savings alone. These are direct, every-day economies—available for every type of steam power. The prevention of one instance of foaming with its resultant delays and expense may more than pay for the application of Signal Foam Meter and Electromatic Blow-off equipment.

"The Signal Foam Meter—Electromatic Blow-off is the greatest educational device ever applied to a locomotive boiler," says a mechanical department official of one of the largest roads.

Write for Bulletin 323

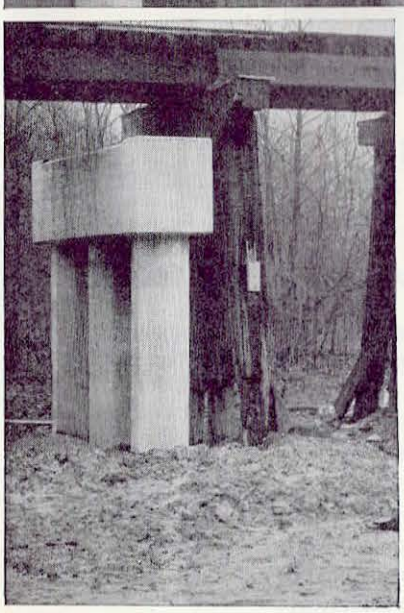
ELECTRO-CHEMICAL ENGINEERING CORPORATION

1358 NORTH KOSTNER AVENUE • CHICAGO, U. S. A.

Subsidiary of The Pyle-National Company

101 MORE SPANS OF PROOF

Concrete 3-pile trestle recently completed at Corning, Ark., before replacement of deck.



Forms for caps held to the piles by friction—no shores—forms used over and over. Concrete for caps furnished by special mixer car. Car switched entirely by crane-driver. Casting of caps followed close behind driving of piles.

Below—typical 3-pile bent complete, ready for quick placement of pre-cast deck. Tracks can be put back in service without waiting for ballast.

3 CONCRETE PILES

COST LESS per ton load capacity than 6 of old style

THEY didn't have to shift stringers to drive these piles. Just two outside the stringers, and one down through the middle—bent after bent—as many as 6 bents per day.

Big 24-inch huskies, good for 75 tons each—easy to cut off or splice. Fewer bents needed. Fewer interruptions. Weeks of time saved.

Three-pile bents greatly reduce the first cost of a trestle that's fire-proof, rot-proof, rust-proof, termite-proof, flood-proof, economical to maintain. Adverse traffic conditions might easily make this type the cheapest.

Sounds good, doesn't it? The new 3-big-pile methods and costs are fully discussed in "Concrete Information Sheet RB-1." Let us send you a copy.

PORTLAND CEMENT ASSOCIATION

Room 193, 33 West Grand Avenue, Chicago, Ill.

YOUNGSTOWN

RAILWAY MATERIAL

TIE PLATES - SPIKES
PLATES - SHEETS
ROOFING AND SIDING SHEETS
BARS AND SHAPES
PIPE - ELECTRIC CONDUIT
WIRE - NAILS - BARBED WIRE
FORGED STEEL UNIONS
SEMI-FINISHED STEEL
ALLOY STEELS

★ ★ ★

RAILROAD TRADE MARK YOUNGSTOWN MATERIAL

Youngstown does not produce "everything in steel".

Instead, it seeks to deserve the top reputation in each classification in which it operates.

Unremitting research is the price this company gladly pays for its reputation as leader in its selected fields.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon and Alloy Steels
General Offices YOUNGSTOWN, OHIO

When you air-condition your cars

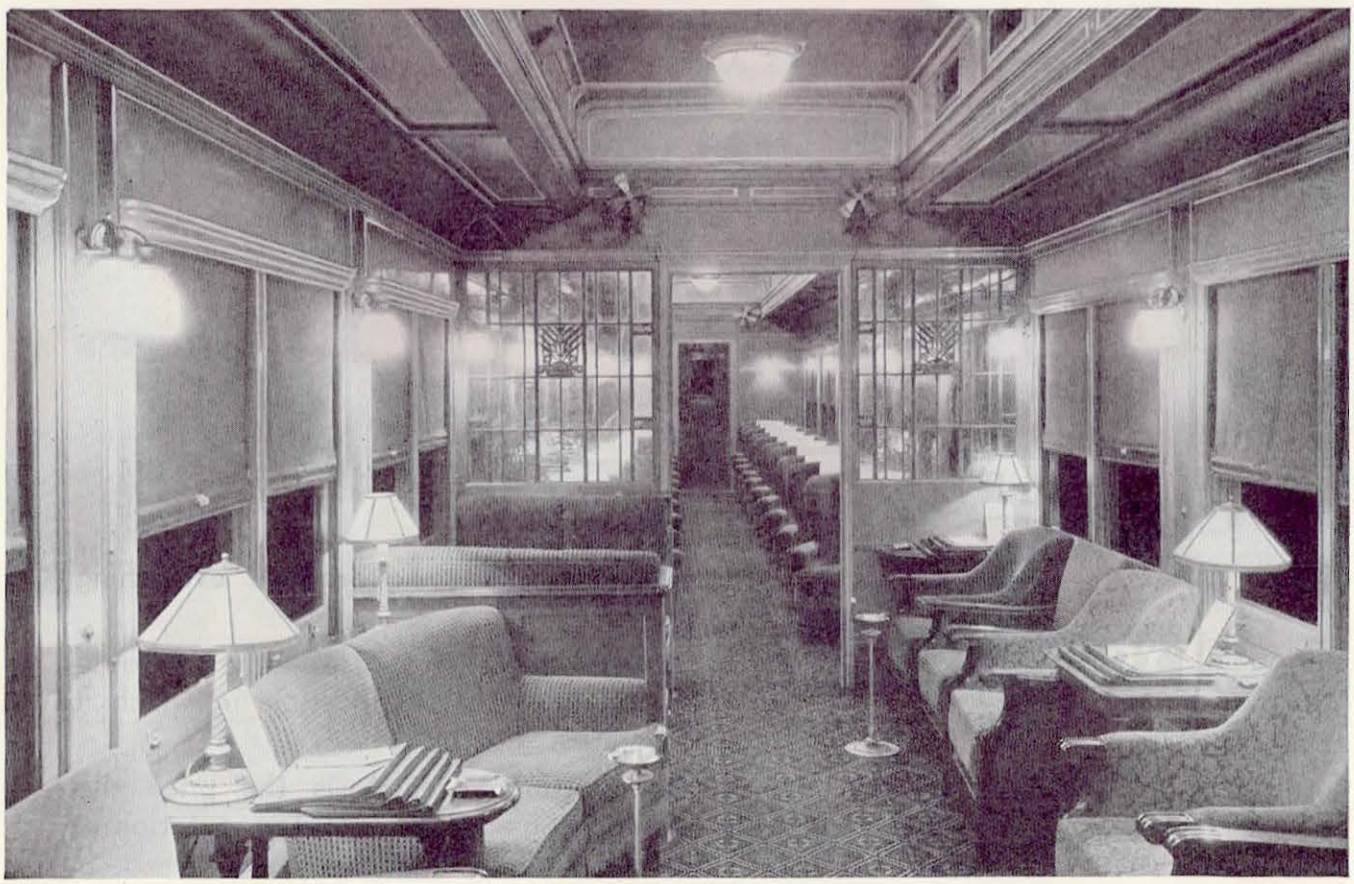
BRING THE LIGHTING UP TO MODERN STANDARDS, TOO

AT the time this Pullman lounge car was rebuilt and air-conditioned, the lighting was also brought up to modern standards. The light colored ceiling plus a generous quantity of well-diffused light make comfortable reading possible without eye-fatigue. The car at present is operated between New York and Boston on the New York, New Haven & Hartford Railroad.

When you rebuild or air-condition your cars, why not bring the lighting up to modern standards of illumination too? Comfortable reading conditions require both air-conditioning and adequate lighting. In car lighting, as well as every other phase of railway lighting, General Electric offers the benefit of its skilled engineering service. This service is yours for the asking. Write to Engineering Department 165, General Electric Company, Nela Park, Cleveland, Ohio.

• • •

There's a MAZDA lamp of General Electric manufacture for every railway need . . . from station and yard lighting to locomotive headlight lamps. The trade-mark GE on the end of every MAZDA lamp of General Electric manufacture is your guarantee that you are getting the most efficient incandescent lamps money can buy.

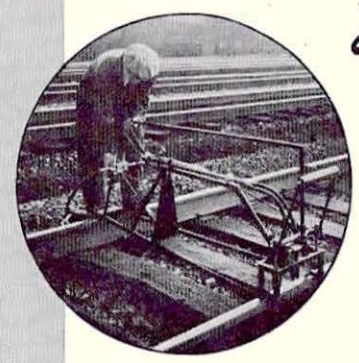


Lighting units in this Pullman lounge car "Waterville" include 24 wall brackets, six table lamps, and nine dome fixtures.

EDISON MAZDA LAMPS

GENERAL ELECTRIC

HIGH SPEED TRAIN OPERATION



Demands Smooth Track

● Rail with battered or chipped ends will not permit the operating economies inherent in the new light-weight, high-speed, streamlined trains. You can, however, have your rail in smooth-riding condition without requiring additional funds for track maintenance.

Building-up rail ends by oxy-acetylene welding with metal harder than the original rail has made thousands of miles of old rail ride like new. In almost every instance, the cost of welding has been more than offset by reduced cost of joint maintenance.

Oxweld Railroad Service also offers a low cost means of postponing batter on new rail which prolongs its smooth-riding quality. The new rail is given increased life through resistance to batter by the Oxweld process of hardening the ends. This special heat-treatment can be done under service shortly after the rail has been laid.

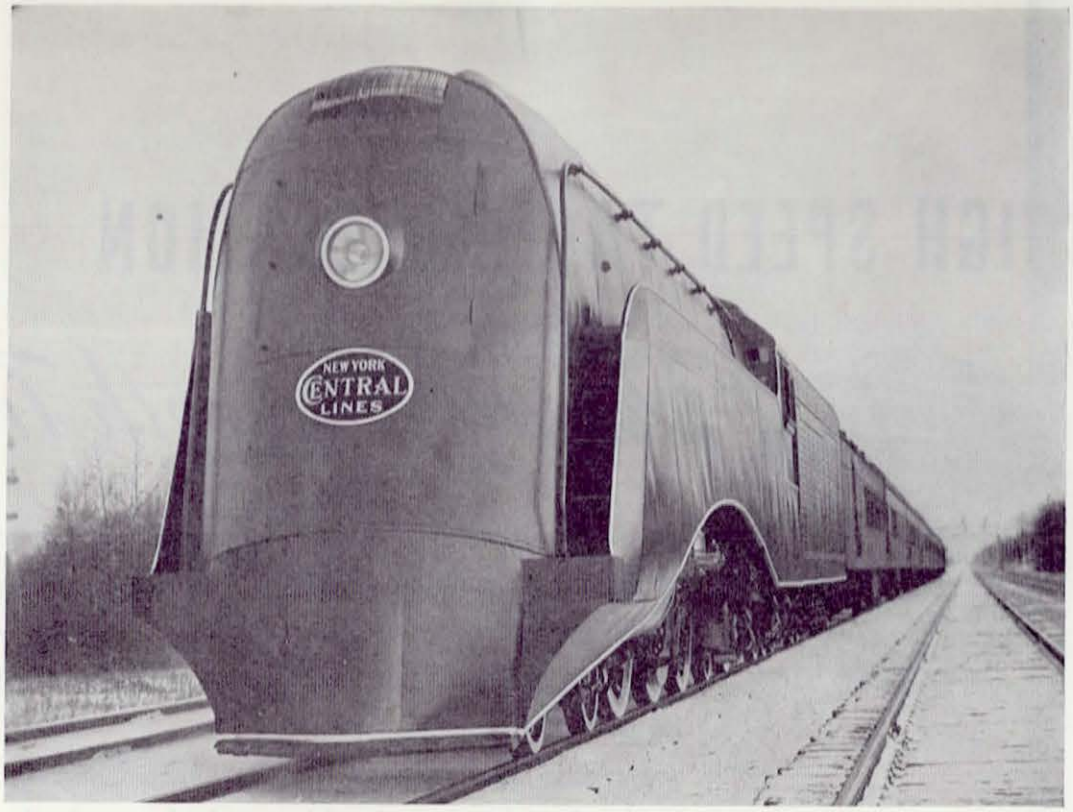
The Oxweld Railroad Service Company shows you how to accomplish these applications economically. Through this source, you can secure the latest information on any of the thousands of oxy-acetylene welding and cutting applications which are contributing greatly to railroad operating economies.

OXWELD RAILROAD SERVICE

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

NEW YORK: Carbide and Carbon Bldg. UCC CHICAGO: Carbide and Carbon Bldg.



How passengers ride in *quiet comfort* behind this modern iron horse

FLASHING its way across the Indiana and Ohio countryside, the "Commodore Vanderbilt" roars by with passengers enjoying amazing quiet and comfort. For the cars that trail this monarch of the rails are thoroughly insulated against heat and cold and against the roar of travel by products of the American Hair & Felt Company and Dry-Zero Corporation.

In fact, most air conditioned cars . . . most regular cars . . . most refrigerator cars have used these quality products for years. More than half a century ago, American and Canadian roads began this long association that has been maintained by constant research, development and improvement of the products listed below.

If you do not know that these materials have recently been improved and made even lighter, perhaps you would like to have one of our engineers supply you with samples and complete information applying to your individual requirements of insulation and sound deadening.

HAIRINSUL	Standard refrigerator car insulation.
DRY-ZERO	The most efficient and lightest weight low temperature insulation known—standard for low temperature cars.
SALAMANDER	For over 30 years the standard insulation for passenger cars.
CARINSUL	Made especially for insulating the letter board of passenger cars.
OZITE STANDARD HAIR FELT	Made by the genuine original platen or felted process and universally recognized as the highest standard of felted insulation.

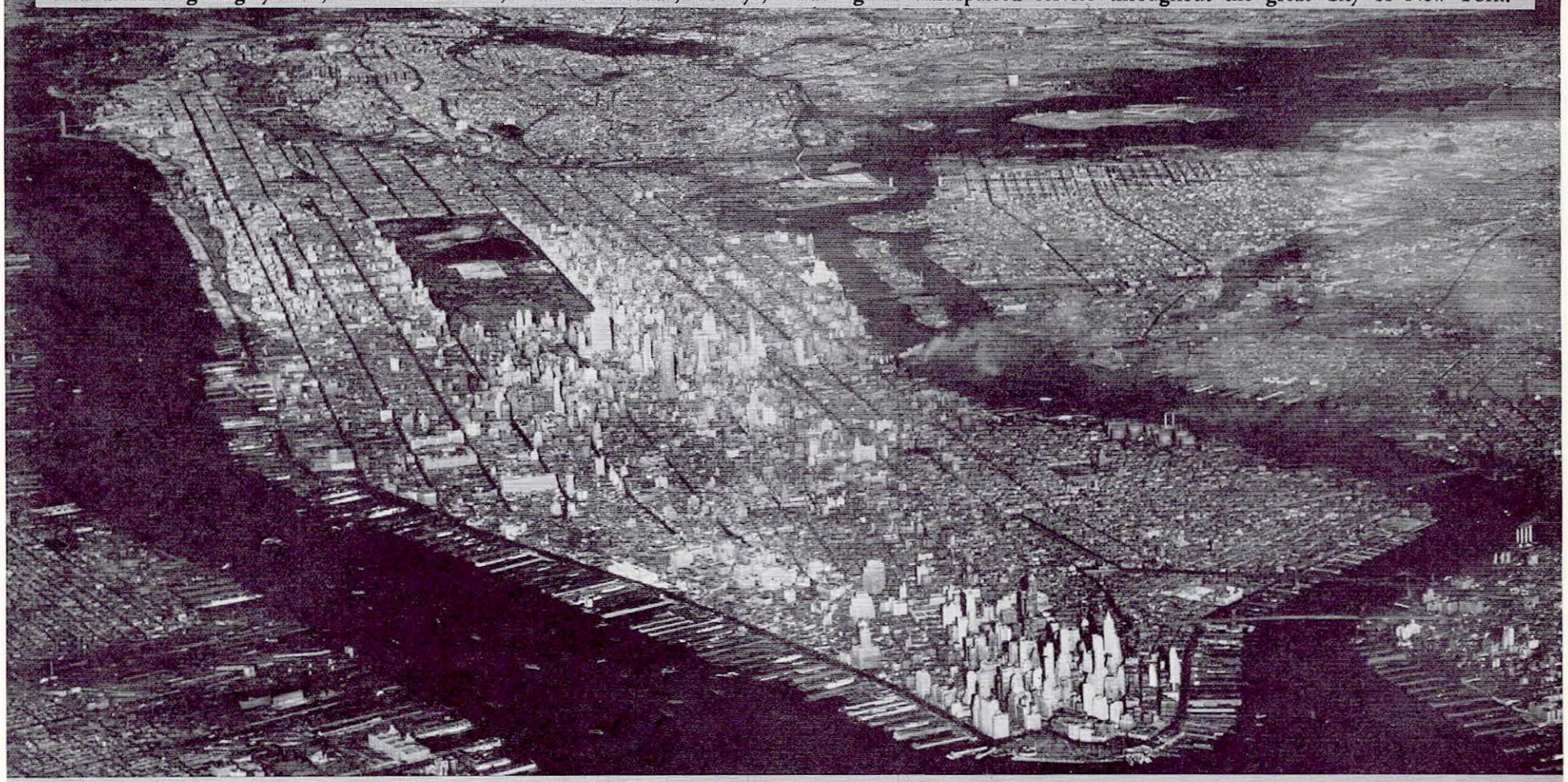
AMERICAN HAIR & FELT COMPANY—DRY-ZERO CORPORATION

(Railroad Division)

Merchandise Mart Chicago

OKONITE IN NEW YORK

From the beginning, whether for telegraph, telephone, the earliest arc and incandescent lighting systems, or on surface cars, elevated railroads, subways, trunk line railroads, river tunnels, or in power plants, OKONITE products have given unsurpassed service throughout the great City of New York.



THE OKONITE COMPANY

FOUNDED 1878

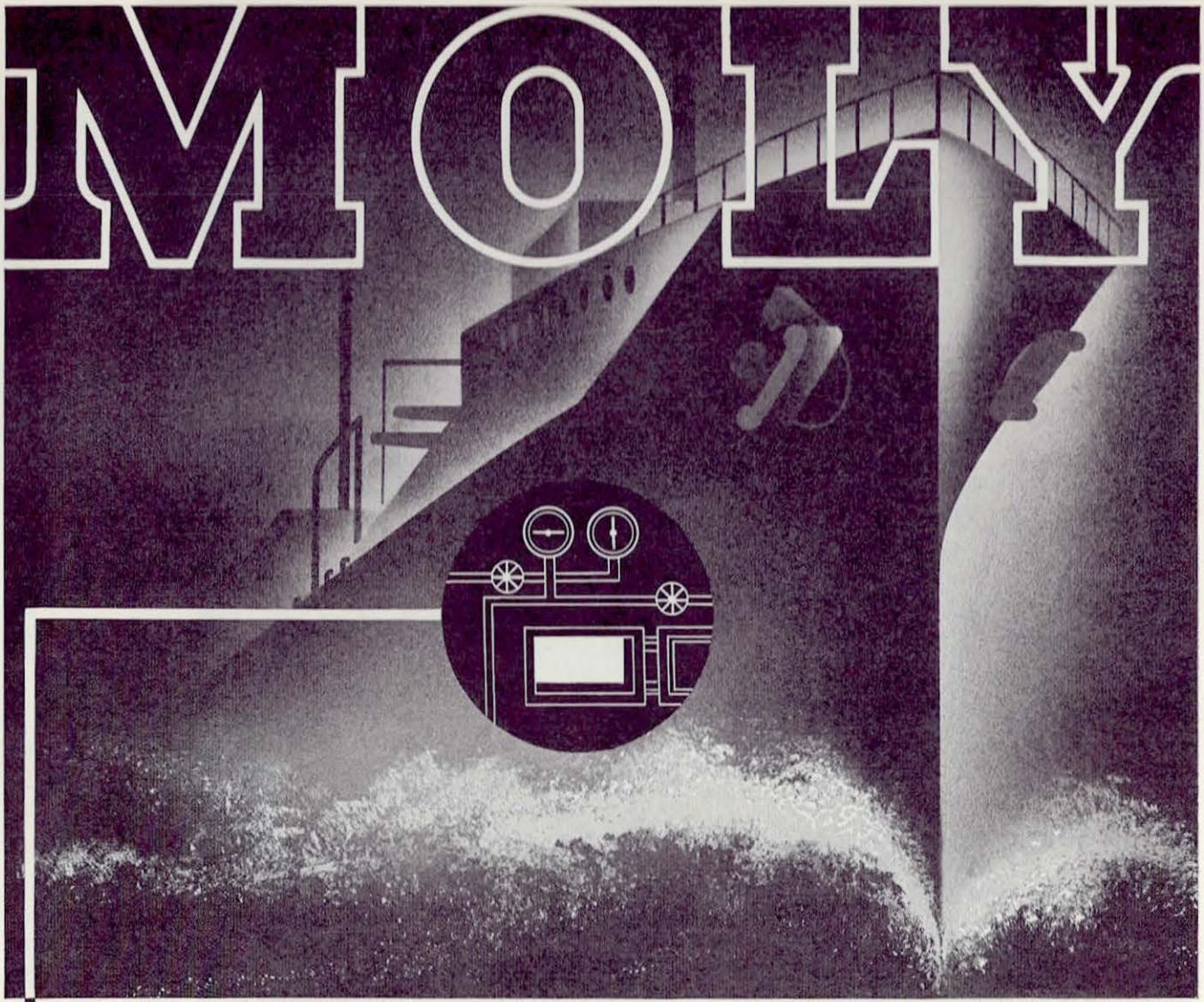
Factories: Passaic, N. J. • THE OKONITE-CALLENDER CABLE COMPANY, Inc. • Paterson, N. J.

Aerial Explorations

SALES OFFICES:

NEW YORK CHICAGO DETROIT PHILADELPHIA PITTSBURGH ATLANTA SAN FRANCISCO LOS ANGELES SEATTLE DALLAS

GENERAL ELECTRIC SUPPLY CORP., BOSTON, MASS.



gives vitality to high-temperature steels

PICTURE the boilers of a modern destroyer splitting the sea at top speed. Or those parts under the heavy pressures and temperatures of oil-refinery requirements. . . . "Moly" gives their steel the *extra* quality to meet extraordinary demands.

Not only is Moly the most effective economical element for raising the creep strength of steel. But it also prevents temper embrittlement, reduces blue brittleness, and intensifies the corrosion-resisting properties imparted by other alloying elements.

Example: A low carbon steel containing from 4-6% Chromium gives good corrosion resistance in oil-refining service. The addition of only .50% Molybdenum has been found to improve greatly this desirable quality and to result in increased recovery in the foundry as well as in the added virtues mentioned above.

While there are various types of steels in commercial use for which creep strength claims are made, the ones that grow in popularity are invariably those containing Moly. The effects of Molybdenum are so remarkable that there are today several foundries which, to insure the retention of their good reputation, insist on adding Moly to their steels of this type.

Keep posted on the rapid progress of Molybdenum. Let us put you on the mailing list of our periodical house organ, "*The Moly Matrix.*" A simple post-card request is all that is necessary. Write also for these interesting books: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement.*" And, if you've an alloy problem of your own, our metallurgists and Detroit experimental laboratory are at your disposal in solving it. Climax Molybdenum Company, 500 Fifth Avenue, New York City. (In Canada: Railway & Power Engineering Corporation, Ltd.)

CLIMAX Mo-lyb-den-um

44 YEARS

of railway signaling achievements

1891 — An Exide Battery was developed meeting the special requirements of signal service and at the same time embodying the established Exide features of dependability and economy.

1894 — The first Exide Battery went into service for pneumatic interlocking.

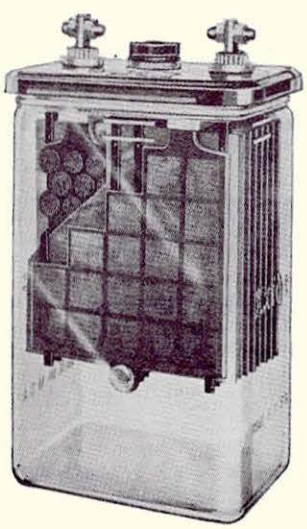
1902 — The famous Manchester Positive Plates and Exide Box Negatives were first offered in the Exide Chloride Battery — soon to become known throughout the railways of the world for long-lasting, low-cost power.

1920 — The Exide A. C. Floating Battery System was announced, offering a number of noteworthy advantages as a form of power supply. Since 1925, the majority of new signal installations have included this Exide System.

1923 — Exide made a further contribution in the sealed glass jar assembly which greatly simplified installation and maintenance routine.

1934 — The Exide Two-Rate Charge Control Unit was announced for use where loads and temperatures vary. At highway crossings, and under a number of similar conditions, this unit operating with the Exide A. C. Floating Battery System will reduce maintenance costs, keep battery fully charged and at same time avoid uneconomical overcharging.

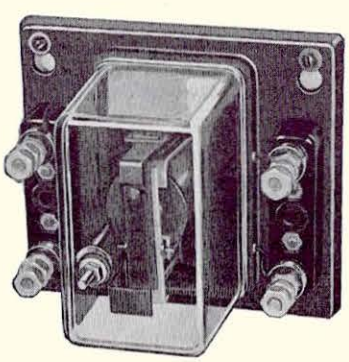
We are proud of this record of accomplishment, and sincerely believe that Exide developments will continue to earn a leading position in the future of railway signaling.



THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

NRA CODE

Exide
SIGNAL POWER

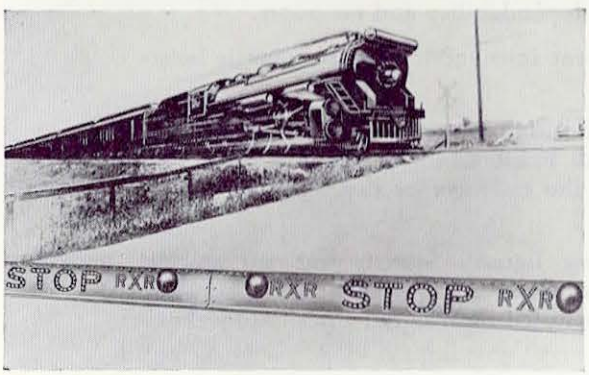


GRADE CROSSING PROTECTION VERSUS ELIMINATION

ONE INVOLVES *SAFETY*
THE OTHER *FREE FLOW OF TRAFFIC*

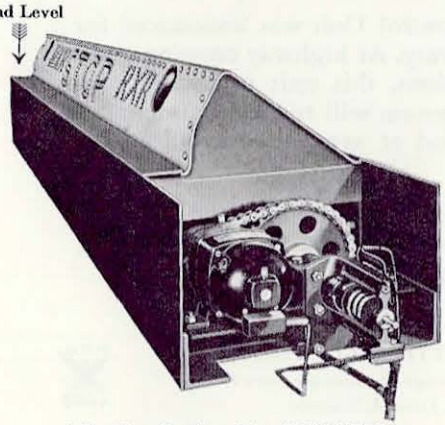
A careful analysis of your grade crossing problem will indicate that certain crossings are in need of protection for safety reasons only, while others should be eliminated because of very heavy vehicular and train traffic. One prominent authority has put the breaking point at 20,000 motor vehicles per day and 50 trains per day. Anything less than this in vehicular traffic and train traffic does not necessarily demand expensive grade eliminations.

Where the problem is one of safety and not the free flow of traffic, we submit for your consideration the AUTO-STOP. This device can protect your entire line, freeing engineers from mental hazards at *every* crossing and giving absolute protection to vehicular traffic.



A New Philosophy in Grade Crossing Protection

Road Level



A Ten Foot Section of the AUTO-STOP
Automatically Controlled, Strong and Sturdy

90% of Crossings Require Protection Only

During the first six months operation of a typical AUTO-STOP installation, less than 3 out of each 100 motor vehicles passing over the highway were delayed. At this point there was an average of 22 trains per day. These delays averaged forty-five seconds for each of the three vehicles. This, compared with the fact that 50 out of every 100 vehicles are delayed by ordinary traffic signals at street intersections indicates that grade eliminations are not necessary, in most cases, to expedite the free flow of traffic.

Protect More Crossings with Money Available

Taking the cost of a very simple grade elimination, say, for illustrative purposes—$75,000 (the average cost is much higher), and supposing that you desire to eliminate two crossings on your railroad, one of which is for traffic reasons and the other for safety only, it is interesting to note that if the $150,000 were divided—$75,000 spent for the elimination for traffic reasons and the balance at $6,500 per crossing spent for AUTO-STOPS (the approximate cost for a 20′ roadway) would eliminate the hazard at eleven additional crossings that need protection from the standpoint of safety. Thus, twelve instead of two crossings would be protected with your original $150,000.

Our illustrated pamphlet, together with data covering six months of operation of a typical installation on a high speed highway in Indiana under the most severe winter conditions and temperatures as low as 11° below zero, will be sent to you upon request.

We have had fifteen months of experience with an AUTO-STOP at another location and this—together with the statistics mentioned above—conclusively establishes the fact that the AUTO-STOP gives absolute and adequate protection under all conditions.

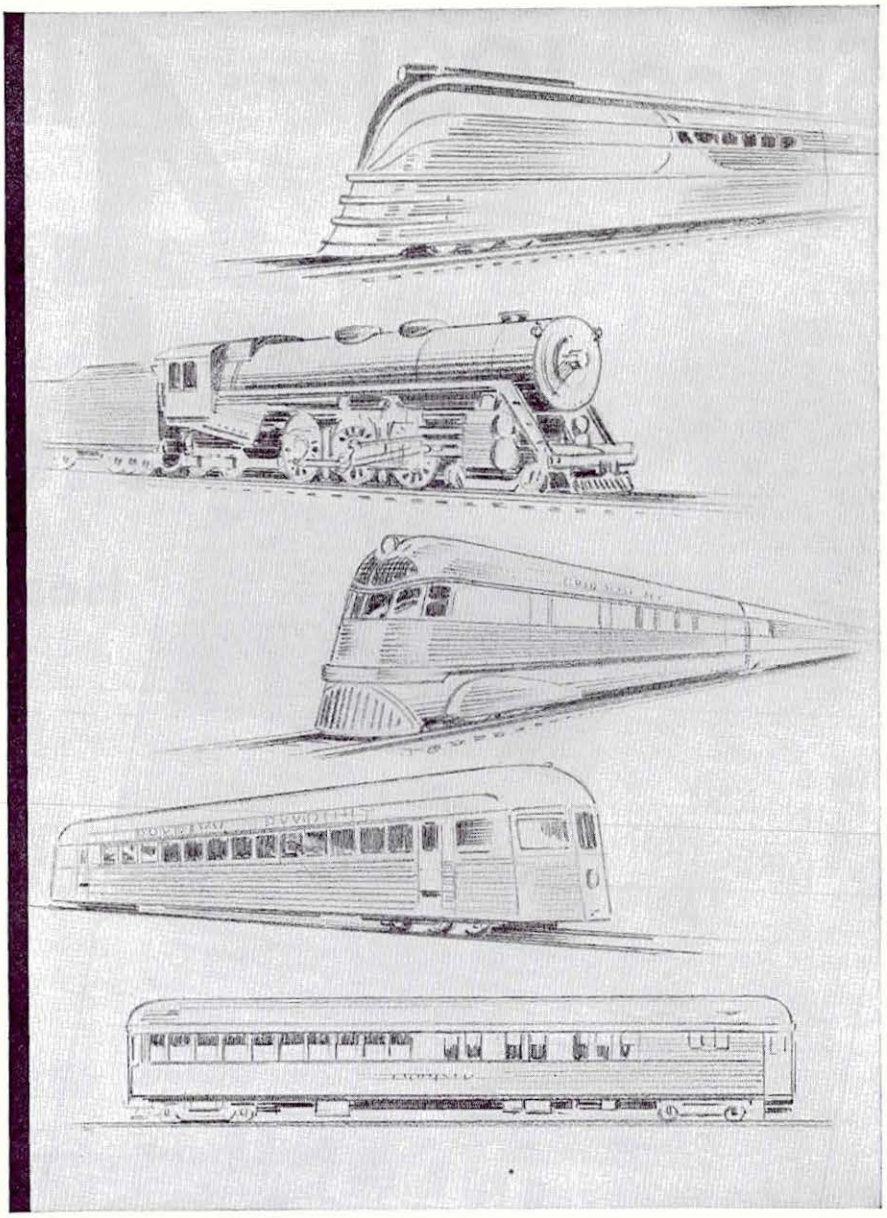
Any Government or Railroad funds, if expended in combination for *necessary* grade eliminations and adequate and positive grade crossing protection, as represented by the AUTO-STOP, would protect a much larger number of crossings and would free engineers forever from the mental hazards to which they are subjected when driving high speed trains.

Therefore, the railroads and tax-payers should not be burdened with expensive* grade eliminations *when a lesser amount of money will protect a greater number of crossings with AUTO-STOPS and provide, during this emergency, an equal amount of labor per dollar expended.

You are invited to see the AUTO-STOP in operation at the Coliseum in Chicago during the National Railway Appliance Association Exhibit, March 11-14th inclusive.

EVANS PRODUCTS COMPANY

Manufacturers of **Union Guardian Bldg. DETROIT, MICH.** *Auto Loaders*



NEW DESIGNS?

Before you write your specifications for new locomotives, high-speed trains, single-car units or lightweight cars, consult Electromet.

Many alloy steels, new in the railway field, have grown up with Electromet. Since 1906 Electromet has pioneered in the field of ferro-alloys and alloy steels. It has developed new alloys and new steels. It has improved others already in use. It has shown the way to employ them correctly.

During all these years Electromet has stored up a vast fund of information on alloy steels. This is yours for the asking. It is not biased in favor of any one composition or producer. Ask an Electromet Engineer to discuss your new designs with you.

PRODUCT OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation

UCC

NRA CODE

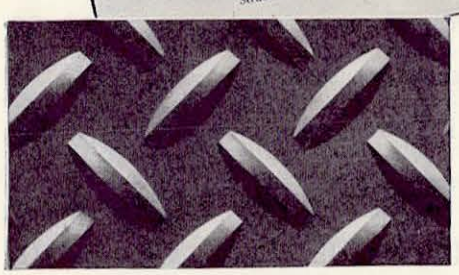
CARBIDE and CARBON BUILDING,
30 EAST 42nd STREET • NEW YORK, N.Y.

Electromet
Ferro-Alloys & Metals

Since 1931 · · · Inland 4-WAY Floor Plate Has "Filled the Bill"

THE NEW
INLAND 4-WAY
FLOOR PLATES
IN ANY
DIRECTION THEY ARE NON-SKID
AND MATCH
No matter at what angle a foot strikes the New Inland 4-Way Floor Plate, there is protection. For this new plate is non-skid from *any* direction.
No matter how laid—end to end, side to side, or *side* to *end*—the patterns on the New Inland Floor Plates match. No waste in cutting for a continuous pattern and neat appearance. And in addition, the design offers ready drainage and sweeping.
Another advantage is lighter weight—at no sacrifice in strength, or safety—because safety is achieved with a new and better arrangement of the projections. Thus Inland introduces and recommends a better floor plate which provides a new degree of utility, economy, safety, and appearance. INLAND STEEL COMPANY, 38 S. Dearborn St., Chicago.
INLAND STEEL
ABLE SERVANT OF THE CENTRAL WEST
Sheets Bars Plates
Structurals Piling
Rails Track Accessories
Bands Rivets Billets

Remember the First Inland 4-Way Floor Plate Ad? October, 1931



Inland 4-Way Pattern Since February, 1932

INLAND 4-WAY—the most important improvement in floor plate in decades—was announced by Inland in October, 1931.

This new floor plate was far in advance of any plate made; it met the need for a better, more serviceable steel floor plate. Its new 4-Way pattern gave it 4 advantages which could not be secured elsewhere: 4-Way Safety (equal resistance to slippage 4-Ways instead of two); 4-Way Matching; 4-Way Drainage; Extra Stiffness.

Many users of floor plate immediately changed to 4-Way. Many who could see no advantage in the available steel plates over competing material now began to use steel floor plates for the first time—Inland 4-Way.

Today there are hundreds using Inland 4-Way Floor Plate for a great variety of purposes—wherever a foot or wheel may slip. INLAND STEEL COMPANY, 38 So. Dearborn St., Chicago, Illinois.

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144-11

we've been "working on the railroad"

right through the Depression . . .

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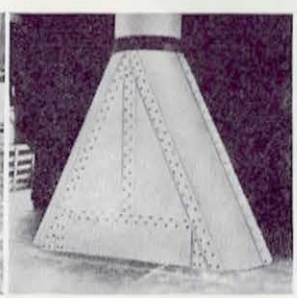
▲ This railroad water line will remain bottle-tight indefinitely, despite the constant vibration caused by passing trains. The pipe is J-M Transite Pressure Pipe.



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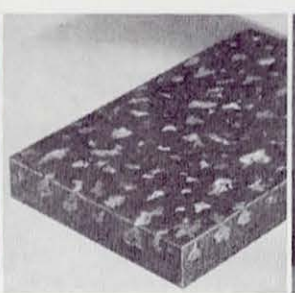

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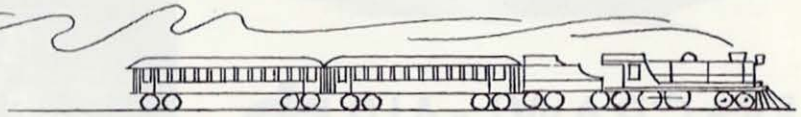

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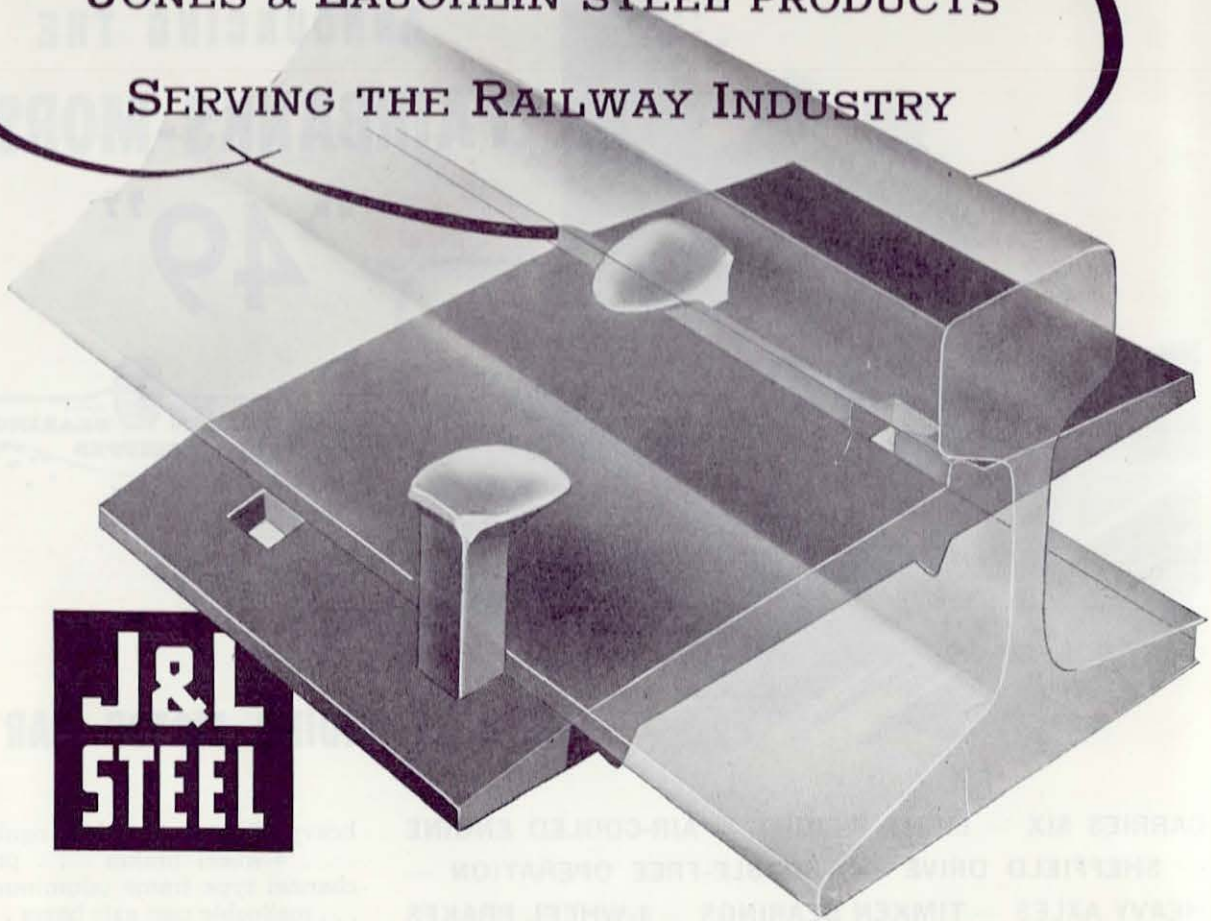

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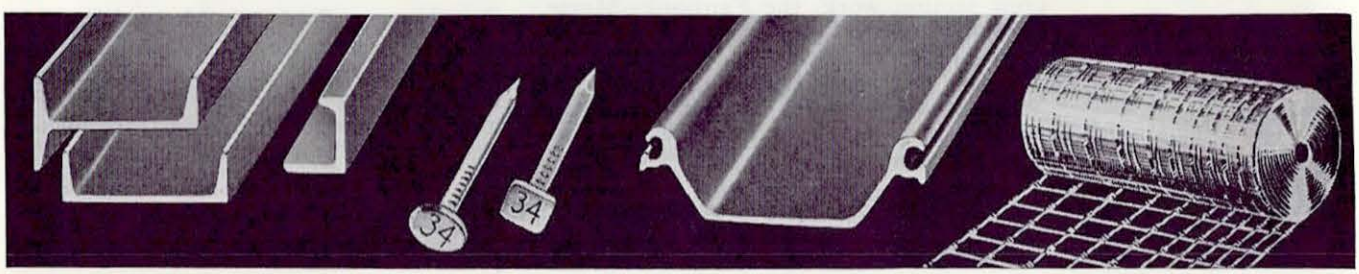

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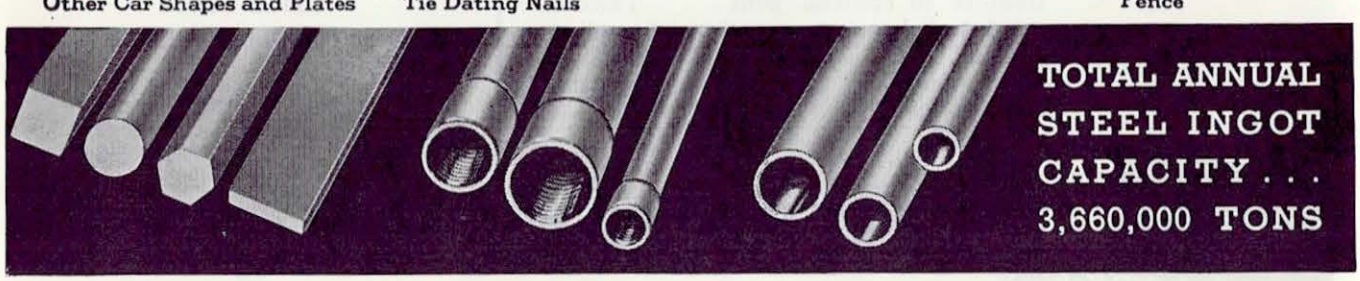

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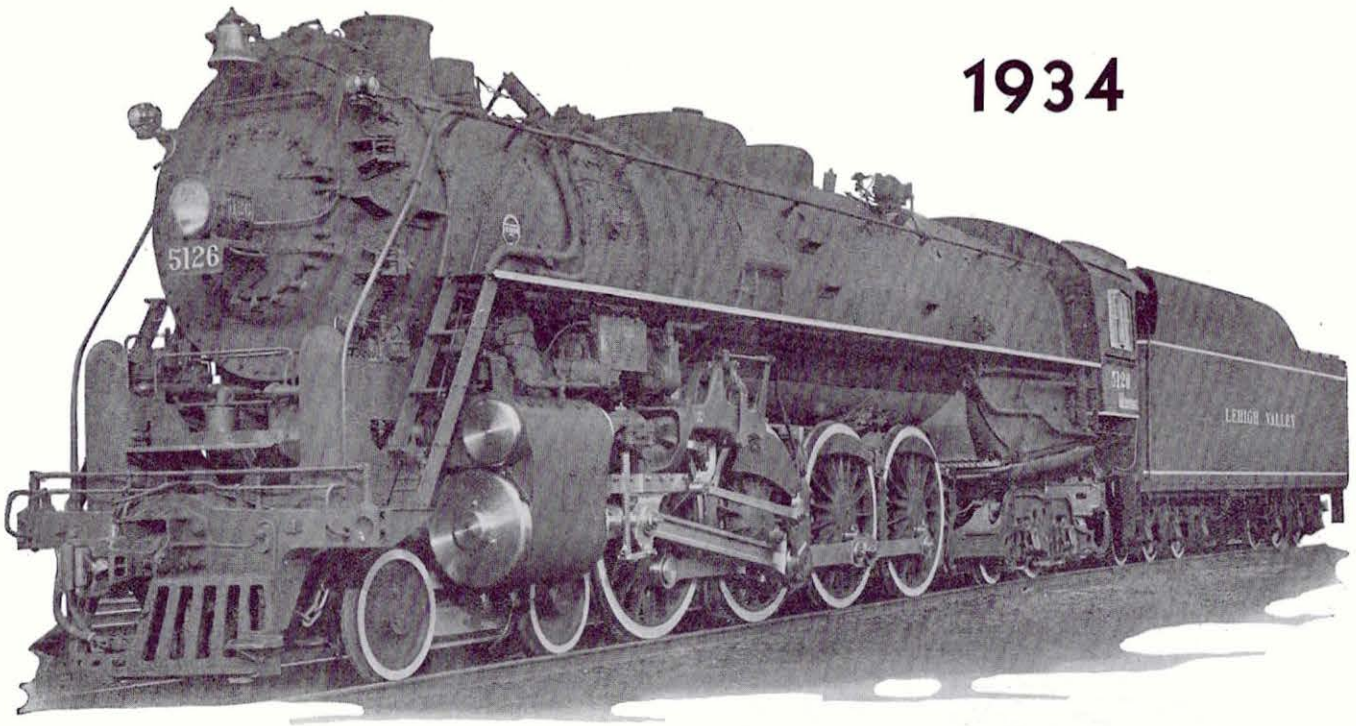

1934

SAVING WITH MODERN POWER

on the Lehigh Valley

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ONE IN 1931

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FIVE IN 1934

The first eleven, which have now been in operation for almost two years, replaced twice as many locomotives formerly used in the same service. This modern power has shown savings approximating 38 per cent on the investment.

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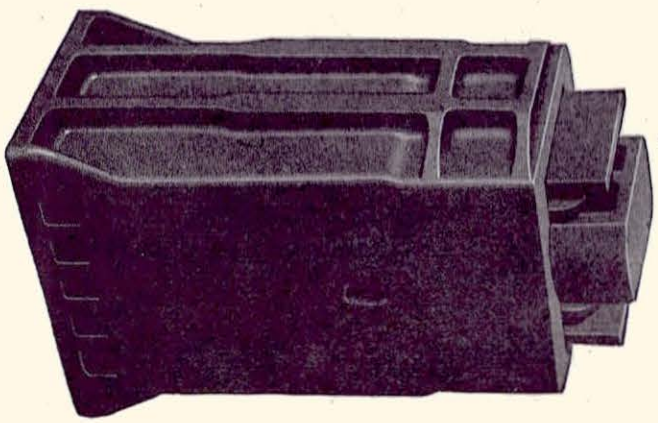
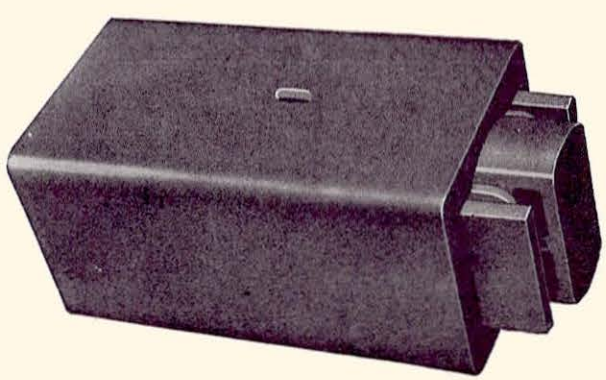


TYPE NY-11-E
Certified A. R. A. 1931

TYPE NZ-11-E
Certified A. R. A. 1931



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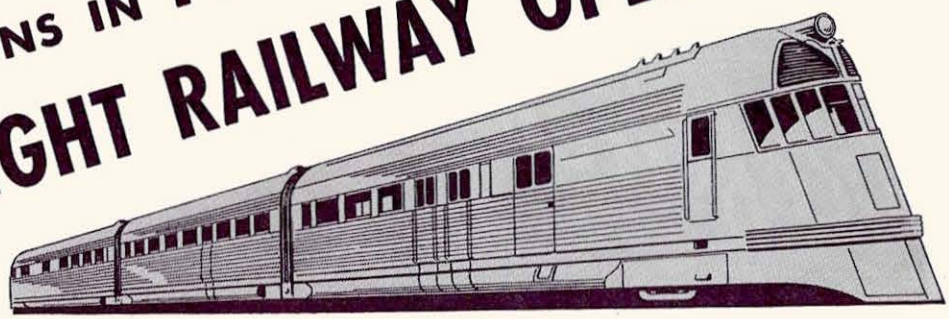

Since November 11, 1934, the Burlington Zephyr has been in regular operation. During 83,500 miles of continuous travel, this light-weight train has demonstrated its ability to earn at least $98,000 per year* more than the steam equipment which it replaces. ($45,000 in increased revenue, $53,000 saved by lower operating-expense—figures welcome to any management.)

LESSON NO. 1 INCREASED REVENUE

During the months of December, 1934, and January, 1935, total Passenger Miles for the Zephyr was 193% above that of the two steam trains (replaced by the Zephyr) during the corresponding period a year before—as compared to a 26% increase on the road as a whole. Questionnaires answered by all Zephyr passengers show that only a small number (5%) were curiosity seekers, and that this number is decreasing.

Zephyr Increase — Road Increase

* *Statistics from a report by Coverdale & Colpitts, Consulting Engineers, New York City. On receipt of your name and address, we would be pleased to send you a copy.*

The Zephyr—a Budd-built, light-weight, high-speed train—is proving its efficiency and practicability in every way. Its strength and safety have been demonstrated to the thorough satisfaction of the public. The fine performance of the Zephyr has proved beyond question one paramount fact: That the Budd system of fabrication—high-tensile, stainless steel, "Shotweld"—is the *only certain way* to greater profits through increased passenger traffic and lower operating-costs.

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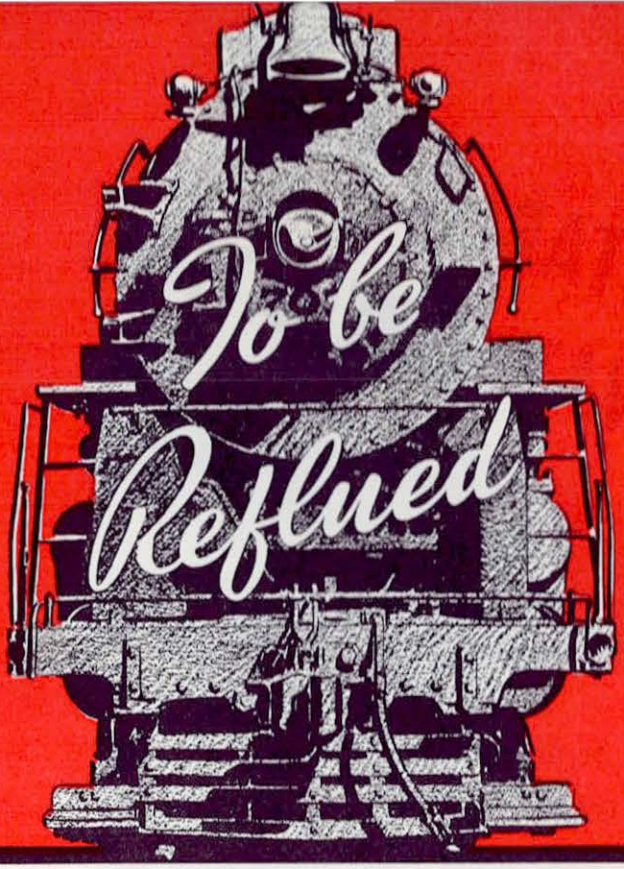

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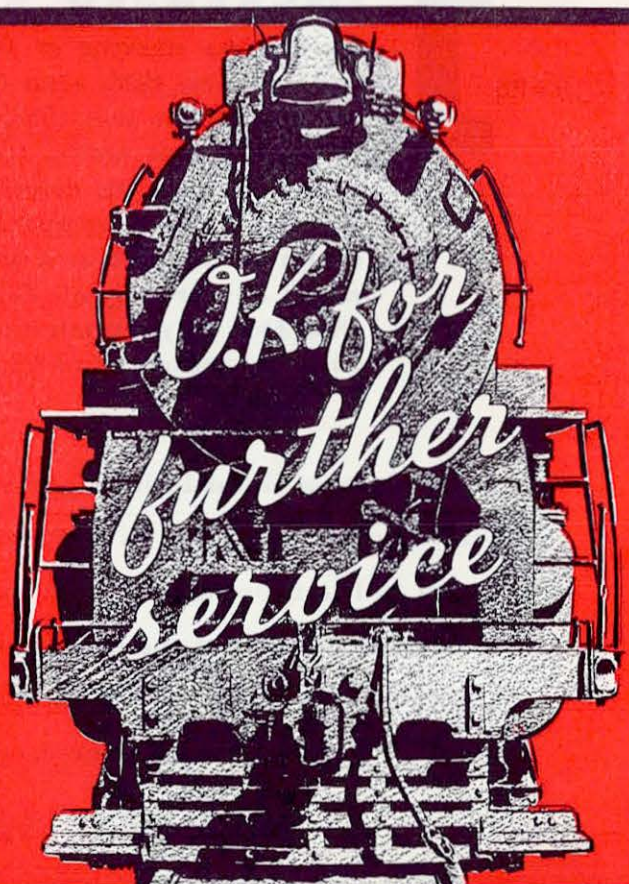
THEY LOOK ALIKE · *but*

FEDERAL EXTENSION GRANTED · *thanks to* NALCO WATER TREATMENT



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The Railway Age is a member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

Subscriptions, including 52 regular weekly issues, payable in advance and postage free: United States and possessions, 1 year $6.00, 2 years $10.00; Canada, including duty, 1 year $8.00, 2 years $14.00; foreign countries, 1 year $8.00, 2 years $14.00.

Single copies, 25 cents each.

Railway Age

With which are incorporated the Railway Review, the Railroad Gazette and the Railway Age-Gazette. Name registered U. S. Patent Office

Vol. 98 March 16, 1935 No. 11

In This Issue

Reduced Costs Feature Zephyr Operation ..... **Page 386**

Tells how Burlington's new streamlined train has cut costs almost in half while it attracts new passenger traffic.

A.R.E.A. Holds Three-Day Convention **394**

A report of this meeting at Chicago, March 12-14, with abstracts of the individual reports presented by 28 of the association's standing or special committees.

Signal Section Convenes in Chicago **416**

A report of this two-day meeting, the program of which included reports dealing with the economics of yard signaling, highway crossing protection, "call-on" signal aspects and instructions for signalmen.

EDITORIALS

Increasing Public Understanding of Transport Industry's Problems 383
Minimizing a Serious Fire Hazard 385

GENERAL ARTICLES

Reduced Costs Feature Zephyr Operation 386
Pension Law Case in Supreme Court 388
Freight Car Loading 388
Freight Car Repairs in Relation to Age 389
Joel S. Coffin, Outstanding Railway Supply Trade Executive, Dies 393
A.R.E.A. Holds Three-Day Convention 394
Signal Section Convenes in Chicago 416
N.R.A.A. Presents Excellent Exhibit 422
Manufacturers Offer New Aids to Efficiency and Economy 426

NEWS **436**

The Railway Age is indexed by the Industrial Arts Index and also by the Engineering Index Service

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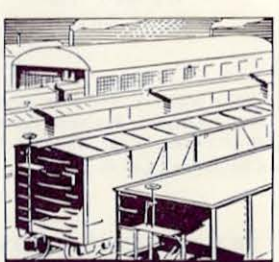

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RAILWAY AGE

Increasing Public Understanding of Transport Industry's Problems

> The great idea of bringing service, public utility and otherwise, within the reach of the masses, and of taking advantage of the opportunities which science and invention have afforded to make life happier, richer and better for the teeming workaday millions and doing this on a basis of economic security—that idea is fast gaining ground and there is no one agency that is operating more effectively to make it a reality than is the Railway Labor Executives Association.
>
> *From an Editorial in the B. of L. F. & E. Magazine*

The "opportunities which science and invention have afforded to make life happier and richer" come always from a reduction in the human labor used to produce a given volume of product. Either the same volume as formerly is produced with much less labor, or the same human effort produces a much larger product. In either case there is a gain which can be shared by the producers and consumers alike—in increasing the money income of the former and reducing the prices which the latter must pay.

Labor Saving Only Path to Greater Wealth

Without such saving in labor, science and invention can do nothing "to make life happier and richer." If any group of producers demands an increase in its income without an equivalent increase in its productive efficiency, then it is simply preying on society for the increase it receives. The most spectacular recent contribution of science and invention to the railroad industry is the streamlined diesel train. The train holds out a promise of definite economies in human labor, the principal one of which is that no fireman is required. The Railway Labor Executives Association is insisting, however, by its excess crew bill now before Congress, that the unneeded fireman nevertheless be retained on these trains. Furthermore, it seeks, purely by political pressure, to require the employment of thousands of additional firemen and brakemen to man existing trains—now operated at the highest speed and the best record of safety in history without such employees.

These measures and the six-hour-day bill would prevent "science and invention" in the railroad industry from making any further contribution—in cheaper service—to the happiness and riches of the "workaday millions." Followed to a logical conclusion such measures would put railroad transportation as measured in ton-miles per man-hour, back, so to speak, in the red plush and Pintsch gas era. Someone would have to pay the price of this lowered efficiency. Railway owners could not bear much of it because they have been all but expropriated already. Railway patrons would not stand for it, for in passenger service at least, careful observers incline to the opinion that rates should be reduced rather than increased. Actually in most cases railway employees themselves would be the principal sufferers, because the operation of these "make work" bills would necessitate the discontinuance of many trains which are now being operated.

To take a larger income without increasing the contribution one makes in return for that income is to enrich oneself at the expense of society. "Science and invention," allowed to operate unmolested, have made life richer and happier in the past and can do equally as well today. But if all the profits—and more too—of invention and better methods of operation are to be seized by a selfish group which has no part in applying science and invention to the railroad industry, then what incentive will remain for those who can apply these improvements to apply them? The railway labor executives have achieved a position of great power in the railway industry. It is about time that they realized that, if a man be honorable, he must accept some degree of responsibility as power comes to him.

Mr. Harrison's Realistic View of Competing Labor

In the matter of restrictive, "make work" legislation, there is no indication that the labor executives have any appreciation of the fact that their legislative program is lethal for themselves as well as the railroad industry. In one important respect, however, the economic consciousness of the labor executives has vastly improved under the vigorous chairmanship of George M. Harrison. The union leaders have at last, if the testimony of Mr. Harrison, E. J. Manion of the telegraphers' organization and other of the labor executives in behalf of Co-ordinator Eastman's bill to regulate interstate motor carriers be taken as a criterion, awakened to the fact that low wages and long hours of labor in competing agencies of transport are a men-

ace to the standards of railway labor. Testifying, Mr. Harrison said in part:

> The railway employees, through their labor unions, have been able to establish reasonable, decent wages and working conditions of their industry; they have been responsible for the approved standard of life and living of probably 3,000,000 of our citizens. We believe that those standards are being threatened and will be subject to attack, unless our competitors are required to keep substantially those same principles of decent standards of wages and working conditions for the employees of those industries, and put them on a fair basis of competition.
>
> It has been said by some that the railroads and railroad labor want to regulate the trucks out of business. I want to answer that accusation by saying that railroad labor recognizes that the people of this country are entitled to the most efficient and economical service that can be provided, consistent with all of the elements necessary to provide that service. We think they should have the particular kind of standard that best meets their needs, and we are only interested in urging the regulation of competing forms of transportation, to the extent of placing them on a good, sound economical basis, making the competition for the available business fair, and giving those who are engaged in the industry, from the standpoint of furnishing the service as well as the capital, an opportunity for a fair and just return on their contributions, and we believe that, if that is done, the public will be better served than with the present chaotic conditions.
>
> I want to suggest that there is a great need for the limitation upon the hours of service [of the men] who actually operate the motor vehicles on the highways. We are of the opinion that, because of the absence of any regulation as to the number of hours that motor vehicle operators might be on duty, that it constitutes a great hazard to the operator, himself, as well as the rest of the users of the highway; and we want to propose an amendment to Section 322, which is substantially the present Hours of Service Act governing the employees of steam railroads, with the amendment which is pending in this present Congress, and that is, that all motor vehicle operatives who are on duty continuously for 12 consecutive hours must have 10 consecutive hours off duty, in order to rest before going again on duty.

Those observations by Mr. Harrison represent a decided improvement in economic realism on the part of railway organized labor. The admission that existing railway labor standards are menaced by the low standards of competing agencies suggests the corrolary that it would be dangerous to advance further the standards of railway labor without a comparable amelioration in those of competing agencies. Probably, with the terrific political pressure within the labor organizations, and the prevalence everywhere of the "something for nothing" philosophy, no labor executive could state all the facts of the present situation of railroad labor and expect to continue in office. We do not cavil, therefore, before political realities within the labor organizations with which we have no intimate knowledge, but congratulate Mr. Harrison on stating as much truth as he did, without pursuing its implications too far.

Propaganda vs. Public Interest

Insofar as in the above we have had occasion to criticize the legislative program of the railway unions we suppose our observations, as usual, will be anethematized as "propaganda" by those who disagree with them. Some one has defined propaganda as the "other fellow's" message; one's own message is, by contrast, always "education." A more accurate definition would, we believe, characterize as propaganda a message to the public which was calculated to advance the immediately selfish ends of the persons responsible for the propaganda, regardless of its ill effects on the public at large.

In that more accurate sense of the term, it is perhaps worth while to note that the major policies with regard to transportation which have been advocated by the *Railway Age*, and most other spokesmen for the railways for that matter, have not been propaganda at all. That is to say, these policies have been formulated with the public interest as the primary consideration, and with the welfare of the transportation industry as a whole, rather than that of the railroads alone, constantly in mind. The proof of this assertion is to be found in the adoption, one by one, of the policies we have advocated by cautious and inquisitive public men and by other persons in no way interested in railway management. We have contended for years for equality of regulation of all carriers—while being denounced as propagandists for so doing—and now the opinion of virtually all students of transportation coincides with our own. We have contended for equality of labor conditions in transportation, a principle conceded by the Interstate Commerce Commission in its annual report for 1933, favored by the attorney of powerful trucking interests before a Congressional committee in 1933, and now ably supported by Mr. Harrison.

Supreme Court View of Transport Tax Question

We have urged the unfairness of comparing railroad taxes with those paid for the use of the highways by motor carriers; last week, in the N. C. & St. L. grade crossing case, the United States Supreme Court said:

> While the railway, the sufferer from the construction of the new highway, is burdened with one-half the cost of the underpass, the owners of trucks and busses and others, who are beneficiaries of its construction, are immune from making any direct contribution toward the cost. It is true that one-half of the cost is by law to be borne by the highway fund of Tennessee (except in so far as it may be covered by the federal aid), and that the truck and bus owners and others contribute as taxpayers to that fund. But, while nearly 28 per cent of the gross revenues of the railway is required annually to pay the state and local taxes and the cost of maintaining the roadway acquired and constructed at its own expense, the state commercial motor carriers, which are supplied by the State with the roadway on which they move, pay in state and local taxes not more than 7 per cent of their gross revenues. The taxes laid upon truck and bus owners are clearly insufficient to pay their fair share even of the cost and maintenance of the highways which serve them. Motor vehicle taxes of all kinds, ad valorem, privilege, license plate, and others will not pay for one-half of the annual expenditure in Tennessee for highways. The balance is being paid in part by general property taxes, in part by borrowing and in part by the federal government. Of the ad valorem taxes paid by the railway to the state and the political divisions thereof, about 20 per cent is allocated directly to roads, some of which are no longer feeders to its traffic, but serve as highways for the traffic taken by its competitors.

From the record, we do not believe that either the *Railway Age* or railway spokesmen as a whole can be accused of narrowly selfish aims or claims. Nor do

we believe that anyone in the transportation industry can afford to cling to such aims. The whole industry —not the railroad part of it alone—is sick unto death, and everyone in the industry and the public which buys its services shares in the economic suffering. Transportation is costing the taxpayers billions which they cannot afford to pay. Existing investments—not only in transportation facilities but in homes and business built up around present routes of commerce—are being destroyed by thoughtless and uneconomic duplication. Many thousands of employees of the industry are working for next to nothing, while those whose wages are high have the constant threat of loss of their jobs hanging over them. Meantime, much transportation service is being performed by the railways which could —all costs considered—be better handled by motor vehicle, and vice versa. Anachronistic rules prevent "invention and science" from coming to the rescue of the industry, its employees and its customers.

Agreement Reached, Time to Act Has Arrived

Somehow, in the interest of society itself, the confusion has got to be cleared away. A beginning, on the nature of which substantial agreement has already been reached by disinterested students, can be made with the bills before Congress to regulate waterway and highway carriers and to repeal the fourth section of the Interstate Commerce Act. To advocate such measures can no longer be called propaganda; rather it is a solemn duty devolving upon all intelligent citizens. To call for the defeat of the ill-advised "make work" legislative program of the railway unions is a public service of similar character and urgency.

Minimizing a Serious Fire Hazard

With the more general adoption of fireproof construction, and the more general installation of modern fire-detecting and fire-fighting equipment and apparatus, the fire hazard in many railway buildings has been reduced to a minimum. Unfortunately, this cannot be said of all railway structures, particularly older ones of timber construction, which, in spite of all that may have been done, or can be done, will continue to present a considerable fire hazard to themselves and to valuable property within or adjacent to them. This is true particularly of many waterfront structures that were constructed years ago with unprotected pile foundations and wooden decks and superstructures.

For years pier fires have been the "nightmare" of railway fire prevention forces, and a major concern of engineering and operating officers. Almost invariably exposed on all sides to prevailing winds; largely inaccessible from the standpoint of the most effective attack by land fire-fighting equipment; and often stocked with valuable freight or cargo, frequently combustible in character, not a few old piers are vulnerable to fires in many respects.

Recognizing this, piers built by the railways in recent years have incorporated a high degree of incombustibility, and some have been made of fireproof construction throughout. A notable example of this is the new marine pier of the Pennsylvania at Baltimore, Md., which was described in the *Railway Age* for December 22, 1934. This structure is not only constructed of fireproof materials from water level to roof, but it employs three types of fire protection systems to safeguard the contents against fires which may originate either within or without.

As fire-detection and fire-fighting equipment and systems have been developed, including automatic alarms, wet and dry-pipe automatic sprinkler systems, automatically-controlled standpipe systems and water deluge and curtain systems, they have been applied not only to new piers but also to many of the older railroad piers as well, and, in conjunction with city and company-employee fire-fighting organizations, have provided a substantial degree of fire protection to these old structures. The "Achilles heel" of the fire problem in these piers is the sub-deck level, with its large expanse of dry timber inaccessible from above and practically, if not entirely, inaccessible from the sides. In spite of the exposure involved, few piers have any form of protection below deck, although they may be thoroughly equipped with automatic sprinklers and other fire protection equipment above deck. In fact, many such structures were not even furnished originally with fire stops to break the run of a fire, and, as a result, such structures are in danger of complete destruction under favorable wind conditions. One can recall the disastrous Cunard pier fire in New York only a few years ago, when an under-deck conflagration gutted the entire structure while much of the city's land and marine fire-fighting equipment stood by, powerless to bring it under control. This fire was no exception. Almost all large waterfront cities have experienced similarly disastrous fires.

Stimulated by specific disasters, many old pier structures have been given some degree of under-deck fire protection in recent years. For example, the Pennsylvania has installed wrought iron plate fire stops beneath the decks of a number of its piers in New York harbor, with dry-pipe water-curtain systems to increase their effectiveness. At the same time, it has provided a system of holes in the decks of some of its piers, with readily removable covers, through which sub-deck fires can be located and extinguished with cellar fire nozzles, or at least localized or confined. Likewise, the Boston & Maine has made cellar-nozzle-hole installations in several of its old timber piers at Boston and, as described in the *Railway Age* for January 19, has relieved several serious potential fire hazards at relatively small initial expense and with no upkeep costs.

Reduced Costs Feature Zephyr Operation

Burlington's streamlined train cuts costs almost in half and attracts new passenger traffic

OPERATING expenses of the Zephyr, the Burlington's new streamlined train, have averaged only 53 per cent of those of the steam trains it replaced when it began operation on November 11, 1934. Outstanding among the economies effected is that of fuel: the cost of the Zephyr's fuel, including lubricating oil, having averaged only 28.2 per cent of the average fuel cost of the former steam trains.

Cost Figures Analyzed

From the figures available to date, it has cost an average of $5,152 per month to operate the streamlined, lightweight train, as compared with an average of $9,601 per month for the steam trains it replaced. Expressed another way, the cost per train mile has averaged only 34.21 cents for the Zephyr, compared with 63.75 cents for the steam trains.

The cost of fuel and lubricating oil for the Zephyr averaged $585 per month, or 3.88 cents per mile, as compared with a cost of fuel for the steam trains of $2,073 per month, or 13.77 cents per mile. These costs, in both cases include the cost of transportation and handling of the fuel and lubricating oil.

The wages of the crew for the Zephyr averaged $2,581 per month, or 17.14 cents per mile, as compared with $3,485 per month, or 23.14 cents per mile for the steam trains, the reduction on the Zephyr being accounted for by the fact that its engine crew consists only of the engineman.

The Zephyr's Operating Costs Are 53 Per Cent of Those of the Steam Trains It Replaced

The maintenance-of-power costs have been divided into two classifications—running and general. Under the first heading, running costs, the Zephyr averaged $300 per month, or 1.99 cents per mile as contrasted with $1,538 per month, or 10.21 cents per mile for the steam trains. Under the second classification, general costs, the figures are: Zephyr, $602 per month, four cents per mile; steam trains $753 per month, five cents per mile. The combined maintenance-of-power expenses are thus: $902, or 5.99 cents per mile for the Zephyr and $2,291 per month, or 15.21 cents per mile for the steam trains.

Allowance for Estimated General Repairs

The Zephyr figures were arrived at by taking the actual running cost, plus four cents per train mile as the estimated cost of general repairs when it will be necessary to make them, spread over the total mileage to be made in the meanwhile. It is assumed that general repairs will be necessary after approximately two years' operation, during which time the Zephyr will have made between 350,000 and 375,000 miles. The four-cents-per-mile figure is based on current costs on a number of gas-electric cars now in operation on the Burlington, applied as closely as possible to a proportionately larger operating unit such as the Zephyr. The average cost per steam train mile on one of the divisions in question, the St. Joseph division, plus general, shop and store expense on a pro rate basis, was used for the steam train maintenance-of-power costs.

The average cost per month for train maintenance on the Zephyr was $635, or 4.22 cents per mile, as compared with $766, or 5.08 cents per mile, on the steam trains. For the Zephyr, it represents actual cost, plus ¼ cent per car mile, on the assumption that the train will run about 360,000 miles between general repair periods. For the steam trains, this represents the actual cost based on the system average per car in steam trains. It has been found to cost less to maintain the Zephyr because of its fewer parts; couplers, diaphragm buffers and draft gear being eliminated and air brake parts, trucks and wheels being fewer. A further saving is also effected since the Zephyr, because of its stainless steel finish, requires no exterior paint.

Train Supplies and Expenses

Zephyr train supplies and expenses averaged $262 per month or 1.74 cents per mile, as compared with $301 per month or 2 cents per mile for the steam trains. The Zephyr figures are based on actual cost, while the steam train figures represent the system average. Because of the Zephyr having replaced two steam trains, the switching and servicing cost at Kansas City is materially lower

for the one streamlined train, being $187 per month, or 1.25 cents per mile, as compared with $685 per month, or 4.55 per mile, for steam trains.

Savings Effected

The saving in operating expenses, based on the figures so far available, average approximately $4,450 per month, or $53,400 per year.

Much of this saving is undoubtedly the result of reduced weight, the Zephyr weighing 218,800 lb., including fuel, sand, oil, water and food supplies, as compared with a weight of 627,800 lb. for the train it replaced between Lincoln and Omaha, and 809,000 lb. for the train replaced between Omaha and Kansas City, the difference in the two steam trains being largely due to the operation of a parlor-diner on the Omaha-Kansas City run. An additional car, when completed, is to weigh about 44,000 lb., which will bring the total weight of the Zephyr to approximately 262,800 lb. The loads on the trucks of the Zephyr, including everything but the pay load, are:

Engine Truck	97,103 lb.
No. 2 Truck	50,249 lb.
No. 3 Truck	43,825 lb.
No. 4 Truck	27,670 lb.

This results in the following axle loads:

No. 1 Axle	48,551 lb.
No. 2 Axle	25,124 lb.
No. 3 Axle	21,912 lb.
No. 4 Axle	13,835 lb.

It so happened that the Burlington was in need of passenger equipment at the time the Zephyr was bought, and would have had to purchase cars in any event. This more or less equalized the depreciation factor in considering the comparative costs of the Zephyr versus steam trains. It also renders the interest and carrying charges between the two roughly equivalent.

Accurate depreciation figures based on experience are, of course, unavailable so far as the Zephyr is concerned, there being no previous experience to guide estimators in this regard. Insofar as the train itself is concerned, considered as three passenger cars apart from the engine, the rate of depreciation should be less than that of other passenger cars by reason of the fact that non-corrosive steel is used in their construction, and corrosion plays an important part in car depreciation.

Schedule Features

The Zephyr leaves Lincoln, Neb., at 7:30 each morning and makes the 55 mile run to Omaha in 55 minutes, an average speed of 60 m.p.h., arriving at 8:25 a. m. The steam train it replaced on this run left Lincoln at 6:55 and arrived in Omaha at 8:10.

The Zephyr lays over in Omaha for 35 minutes, or until 9:00 a. m., before proceeding to Kansas City, arriving there at 1:00 p. m., taking 240 minutes for the 195 mile run, including, among others, a station stop of six minutes at St. Joseph, Mo. The steam train it supplanted left Omaha at 8:15 a. m., arriving in Kansas City at 1:35 p. m., a saving of 80 minutes in favor of the Zephyr.

Returning, the Zephyr leaves Kansas City at 2:30 p. m., arriving at Omaha at 6:30 p. m. as compared with the northbound steam schedule of 5 hr. 25 min. The streamlined train leaves Omaha at 7:00 p. m., arriving at Lincoln at 7:55 p. m., as compared with the former steam train schedule of 1 hr. and 20 min. between these points.

The Right-of-Way

The Zephyr operates at present under slow orders limiting it to 50 m.p.h. on 8 miles of line, and to 75 m.p.h. on 85 miles, its regular cruising speed being 85 m.p.h. The route is 84 per cent tangent track with a maximum curvature of three degrees. The superelevation of the curves has not been increased since the Zephyr began its operations for the Zephyr operates over a line where freight business is normally heavy, and it was not felt that any possible increase in the Zephyr's speed on curves would justify the handicap to freight operation of excessive superelevation for its operation.

The Zephyr on Its Way from Omaha to Kansas City

Of the 250 miles of line over which the Zephyr is operated, 105.1 miles are double track. Between Kansas City and Omaha, where the line lies in the valley of the Missouri River, there are few grades. Between Omaha and Lincoln, however, short grades of 1.25 per cent are encountered in both directions.

A little over three-fourths of the track is laid with 90 lb. rail, with 100 lb. and 110 lb. in the rest.

On this part of the railroad there are 175 grade crossings, relatively few of which are important. The greater proportion of these crossings are farm roads, while the grades are separated at 28 points in the 250 miles.

Traffic

Figures as to the traffic handled have been released by the Burlington from time to time and published currently in the *Railway Age*. Briefly stated, the number of passengers using the Zephyr has increased 150 to 200 per cent as compared with an increase for the Burlington system as a whole of 26 per cent for the period named.

The service has proved so successful that a fourth car is now in the course of construction which will be installed in the train as soon as it can be built; it will increase the Zephyr's seating capacity from 72 to 112.

Pension Law Case In Supreme Court

WASHINGTON, D. C.

ARGUMENTS were to be heard by the Supreme Court of the United States this week on the appeal of the Railroad Retirement Board from the decision of the supreme court of the District of Columbia on October 30 holding the railroad retirement act unconstitutional. The validity of the act had been attacked by 134 Class I railroads, the Pullman Company, and the two express companies; they have filed a voluminous brief in the case. A summary of their argument, included with the brief, follows:

The first main division of the brief shows that the act has no real, substantial or reasonable relation to efficiency or safety in interstate transportation and hence is beyond the power of Congress to enact.

Section 2(a) of the act shows the emphasis it gives to social and non-commerce objects and the mandate of the last sentence of the section requires administration and construction in accordance with the real intents and purposes of the act, to provide unemployment and old age relief. It shows the real intent is to achieve "the greatest possible use of resources" for those purposes, and that means "resources" of the railroad. The government furnishes none and the employees get all theirs back.

The decisions of this court hold that the means adopted must be reasonably related to a legitimate end within delegated powers, that that relation is not sufficient if it be only remote or unsubstantial, and that whether this relation exists is a judicial question, not a question within unreviewable legislative discretion.

1. The act is analyzed and it shows by the persons to whom it applies and the occasions and conditions upon which it operates that it is not in reality related to interstate transportation but only to broader and unauthorized social purposes. In last analysis only two theories are invoked in support of the act in an attempt to relate it to the commerce power: (1) removal of "superannuated" employees and (2) creation of employee contentment.

2. The theory of elimination of superannuation fails as a basis of reasonable relation to efficiency and safety of interstate transportation and of constitutional power:

a. The evidence shows that in fact there is no excess superannuation among railroad employees.

b. Removal of older employees has no reasonable relation to *safety* in interstate transportation. Older men cause fewer accidents than younger men.

c. Removal from service on the arbitrary basis of mere age or service age, wholly disregarding fitness or unfitness, as this act does, has no reasonable relation to either efficiency or safety.

d. Whatever relation removal of older men might have to either efficiency or safety would be wholly achieved by a retirement requirement alone and there is no justification for the distinct and added pension requirement, which is the requirement that takes respondents' property. The "humane" reasons invoked for pensions after retirement are no basis of constitutional power to take property of carriers and give it to their employees.

3. The "contentment theory" is wholly fanciful and gives the act no real, reasonable or substantial relation to either efficiency or safety in interstate transportation. If that theory were indulged as source of power to take property, there would be no limit to the extent to which carrier property could be taken and given to employees for their contentment, and constitutional limitations and guaranties would be wiped out.

4. The wholly different voluntary pension plans of carriers furnish no support for the act or for the argument that the act has reasonable relation to efficiency or safety in transportation.

5. Since the legislative means adopted by the act are demonstrated to have no reasonable relation to promoting efficiency and safety of interstate transportation, being related throughout solely to the unauthorized social objects of old age and unemployment relief for which carrier property cannot constitutionally be taken, under the authorities the act is unconstitutional. It is not in reality a regulation of commerce but is

(*Continued on page 425*)

Freight Car Loading

WASHINGTON, D. C.

REVENUE freight car loading in the week ended March 2 totaled 604,642 cars, an increase of 51,746 cars as compared with the week before, which included a holiday, but a reduction of 1,075 cars as compared with the corresponding week of last year. As compared with 1933 this was an increase of 123,434 cars. Loading of miscellaneous freight, grain and grain products, forest products, and ore showed increases as compared with last year. The summary, as compiled by the Car Service Division of the Association of American Railroads, follows:

Revenue Freight Car Loading

For Week Ended Saturday, March 2

Districts	1935	1934	1933
Eastern	141,722	148,127	113,641
Allegheny	119,238	121,930	92,277
Pocahontas	45,460	43,249	31,246
Southern	94,759	90,601	76,499
Northwestern	68,663	69,787	55,223
Central Western	85,597	83,810	70,879
Southwestern	49,203	48,213	41,443
Total Western Districts	203,463	201,810	167,545
Total All Roads	604,642	605,717	481,208
Commodities			
Grain and Grain Products	29,124	29,107	27,973
Live Stock	12,727	14,031	14,038
Coal	138,968	158,976	93,910
Coke	8,509	10,791	4,879
Forest Products	26,028	21,576	15,362
Ore	3,288	2,646	1,368
Merchandise L.C.L.	160,320	162,459	162,269
Micellaneous	225,678	206,131	161,409
March 2	604,642	605,717	481,208
February 23	552,896	574,908	462,315
February 16	581,981	600,268	517,529
February 9	592,560	573,898	504,663
February 2	598,164	565,401	486,059
Cumulative Total, 9 Weeks	5,100,714	5,103,273	4,375,982

The freight car surplus for the first half of February averaged 306,940 cars, a decrease of 34,978 cars as compared with the average for the first half of the month. The total included 194,357 box cars, 61,417 coal cars, 27,591 stock cars, and 9,210 refrigerator cars.

Car Loading in Canada

Car loadings in Canada for the week ended March 2 totaled 44,034, as compared with 42,610 in 1934, and 45,012 cars for the previous week, according to the compilation of the Dominion Bureau of Statistics.

	Total Cars Loaded	Total Cars Rec'd from Connections
Total for Canada:		
March 2, 1935	44,034	23,555
February 23, 1935	45,012	23,769
February 16, 1935	45,299	23,563
March 3, 1934	42,610	25,916
Cumulative Totals for Canada:		
March 2, 1935	383,151	200,426
March 3, 1934	361,860	196,411
March 4, 1933	290,426	155,203

THE 1934 OPERATING DEFICIT of the Belgian National Railways totaled 44,800,000 francs, according to a recent report received by the U. S. Department of Commerce. This amount increased to between 140,000,000 and 150,000,000 francs after taking account financial charges, and it compares with a 13,300,000-franc operating deficit, which was increased to 125,500,000 francs after including financial charges, during 1933. The 6 per cent interest paid on preferred shares is not paid by the railways, but by the State on the first of September of each year.

Freight Car Repairs in Relation to Age

Data on heavy repairs to 98,000 freight cars and rebuilding of 35,000 presented and analyzed in a report to the Railway Car Institute

THE study of the relationship between age and the cost of freight-car maintenance, based upon a detailed analysis of the freight-car maintenance costs and rebuilding programs of nine railroads, has been made for the American Railway Car Institute by Coverdale & Colpitts. Five of the railroads are in the eastern district, two in the southern and two in the western district. Some of them have a preponderating box-car ownership, while others are heavy coal carriers. One of the western railroads is a transcontinental line. In size, they range from a little over 1,000 miles to more than 10,000 miles of road. Detailed studies were made of repairs to box cars (including automobile cars), gondolas and hoppers. The following is an abstract of the report of the engineers to the American Railway Car Institute.

Heavy Repair Costs—Box Cars

The study includes data on heavy repairs to 98,147 freight cars on eight railroads during the period 1924-1934, the periods varying on the individual lines.

In the case of box and automobile cars we secured information on 47,460 heavy repairs on seven railroads. Eighty-six per cent of these cars were of 40-ton capacity.

Table I shows the average cost per car repaired for each of the seven companies, by five-year age groups. Although one might expect to find mounting costs in each succeeding age group, this is not always true because of differing repair and retirement policies. After freight cars reach a certain age (usually in the vicinity of 20 years) certain railroads place them in rough freight service which does not necessitate the heavy repair costs which would be required to put the cars in condition for high-grade loading. The effect of this policy is particularly noticeable on railroad *B* which makes a practice of giving no heavy repairs to cars when they have had 20 years service. It is natural that on this line highest cost per car should occur in the 16-20 year group.

Attention is also called to railroad *G* which includes box cars only in the 6-10-year group. In this instance there is a definite relationship between age and cost of repairs even within this age group, the cost per car for repairs being $245 for cars six years old; $397 for cars eight years old, and $456 for cars ten years old.

Because of the various reasons for differences in unit costs on the several railroads, it would be improper to combine the figures and obtain a composite cost per car repaired for all the lines involved. It is possible, however, to make a comparison between several of the roads by the use of index numbers.

On three of the seven companies shown in Table I the cars studied did not have a sufficiently long range in age to admit of establishing a trend. However, on the remaining four railroads the range in ages covered 25 years or more and it was possible to make comparisons by means of index numbers. Table II represents the trend on 35,605 heavy repairs, or 75 per cent of the total number of heavy repairs studied.

Effect of Box-Car Construction on Costs

Of the 47,460 box-car repairs studied 40,641, or 86 per cent, were on cars with steel underframes and only 14 per cent on cars with composite or wooden underframes. Only 13 per cent of the cars repaired had arch-bar trucks, the remainder having cast-steel side frames. The detailed figures showing comparative costs for cars

Table I—Heavy Repairs to Box Cars*—Cost Per Car Repaired at Various Ages

Road	Age groups, years	No. of cars repaired	Total cost	Average per car repaired
A	26–30	...	.....	...
	21–25	68	$5,287	$78**
	16–20	37	2,695	73**
	11–15	67	5,178	77**
	6–10	...	.....	...
	1–5	74	2,028	27**
	Total	246	$15,188	$62**
B	26–30	....	.....	...
	21–25	2,946	$1,102,039	$374
	16–20	5,663	2,333,013	412
	11–15	4,928	1,180,215	239
	6–10	7,156	820,116	115
	1–5	4,808	376,838	78
	Total	25,501	$5,812,231	$228
C	26–30	....	.....	...
	21–25	54	$36,736	$680
	16–20	3,807	2,611,280	686
	11–15	1,079	717,723	665
	6–10	....	.....	...
	1–5	....	.....	...
	Total	4,940	$3,365,739	$681
E	26–30	660	$447,989	$679
	21–25	663	438,260	661
	16–20	303	158,620	523
	11–15	1,073	605,623	564
	6–10	81	17,422	215
	1–5	....	.....	...
	Total	2,780	$1,667,914	$600
F	26–30	108	$50,503	$468
	21–25	411	155,794	379
	16–20	159	45,033	283
	11–15	62	15,175	245
	6–10	4,002	705,351	176
	1–5	2,336	343,052	147
	Total	7,078	$1,314,908	$186
G	26–30	....	.....	...
	21–25	....	.....	...
	16–20	....	.....	...
	11–15	....	.....	...
	6–10	2,986	$1,107,162	$371
	1–5	....	.....	...
	Total	2,986	$1,107,162	$371
I	26–30	....	.....	...
	21–25	....	.....	...
	16–20	....	.....	...
	11–15	1,395	$503,595	$361
	6–10	2,534	851,360	336
	1–5	....	.....	...
	Total	3,929	$1,354,955	$345

* Including automobile cars.
** Direct labor costs only.
Source: This information is based upon specific records in the offices of the railroad companies showing heavy repair costs by individual cars or series of cars.

of different types of underframe and trucks indicate that such differences in construction do not cause any material changes in the cost of heavy repairs when comparisons are made between cars in the same age groups.

Differences in the body construction, however, do cause differences in the repair costs. On two railroads which have cars of both steel-frame body and wooden body construction of the same age the costs for the cars with wooden bodies are somewhat greater per car repaired. Nevertheless, the same general tendency toward increasing costs with increasing ages is found in these figures as in the case of the table for all box cars.

Table II—Trend of Cost of Heavy Repairs Per Box Car Repaired, by Age Groups, Expressed in Index Numbers

Age group, years	Roads A	B	E	F
26–30	...	...	316	206
21–25	150	325	307	215
16–20	140	358	243	161
11–15	148	208	262	149
6–10	100	100	100	100
1–5	52	68	...	84

Table III—Heavy Repairs to Gondola Cars—Cost per Car Repaired at Various Ages

Road	Age groups, years	No. of cars repaired	Total cost	Average cost per car repaired
O	26–30	....	.....	...
	21–25	....	.....	...
	16–20	....	.....	...
	11–15	....	.....	...
	6–10	137	$38,497	$281
	1–5	157	23,393	149
	Total	294	$61,890	$211
P	26–30	....	.....	...
	21–25	13	$5,465	$420
	16–20	217	137,389	633
	11–15	....	.....	...
	6–10	....	.....	...
	1–5	....	.....	...
	Total	230	$142,854	$621
Q	26–30	....	.....	...
	21–25	200	$114,350	$572
	16–20	2,474	1,245,701	504
	11–15	286	157,818	552
	6–10	250	93,088	372
	1–5	....	.....	...
	Total	3,210	$1,610,957	$502
R	26–30	242	$81,724	$338
	21–25	95	26,244	276
	16–20	381	238,457	626
	11–15	542	169,770	313
	6–10	4,515	1,027,372	228
	1–5	2,198	273,860	125
	Total	7,973	$1,817,427	$228
S	26–30	28	$5,053	$180
	21–25	618	149,376	242
	16–20	267	61,492	230
	11–15	....	.....	...
	6–10	188	53,337	284
	1–5	....	.....	...
	Total	1,101	$269,258	$245
V	26–30	....	.....	...
	21–25	1,147	$147,147	$128
	16–20	1,974	230,746	117
	11–15	1,127	87,741	78
	6–10	7,469	498,390	67
	1–5	2,205	145,367	66
	Total	13,992	$1,109,391	$80

Source: This information is based upon specific records in the offices of the railroad companies showing heavy repair costs by individual cars or series of cars.

Gondola Cars

Our study of gondola-car repairs involved an analysis of unit costs for 26,730 cars on six railroads. Ninety-four per cent of the cars were 50-ton capacity. Table III shows the cost of heavy repairs per unit, the figures being shown by five-year age groups.

The normally expected higher repair costs for older cars are not as evident on this table as in the case of box cars. There are two principal reasons for this. The first is the same as the reason given under the discussion of box-car repairs; namely, that certain railroads as a matter of policy use their older cars in limited service and do not spend enough money in repairing them to put them into first-class condition. The second reason is that one of these lines, railroad *S*, has many old gondolas with wooden underframes and bodies. While these cars are repaired at much more frequent intervals, the cost for each heavy repair is considerably lower than on steel gondolas.

Table IV is an index table for heavy repair costs on gondola cars, similar to that for box cars. Only those railroads having a sufficient spread in age groups were used and railroad *S* was omitted because its costs for older cars are not comparable as explained above.

The heavy repairs on the above three railroads constitute 94 per cent of the total heavy repairs to gondolas studied.

Of the 26,730 gondola cars repaired 91 per cent had steel underframes and 85 per cent were equipped with cast-steel trucks. Most of the cars had wooden or composite bodies, there being only 3,440 cars with steel bodies, or 13 per cent of the total.

A restatement of the index tables shown above to give the differences in trends for all-steel cars as against composite cars can be made, as all of the cars on railroad *Q* are of all-steel construction, whereas the cars repaired on railroads *R* and *V* are all of composite construction.

Table IV—Trend of Cost of Heavy Repairs Per Gondola Car Repaired, by Age Groups, Expressed in Index Numbers

Age group, years	Roads Q	R	V
26–30	...	148	...
21–25	154	121	191
16–20	135	275	175
11–15	148	137	116
6–10	100	100	100
1–5	...	55	99

Hopper Cars

The number of hopper cars repaired in our study was 23,957. Of this number 85 per cent were cars of 50- or 55-ton capacity. Table V shows the cost per heavy repair to hopper cars on seven railroads by five-year age groups. The correlation between age and cost of repairs is more striking in the case of hopper than gondola cars, primarily because there are not so many differences in the construction of the cars. The index table for hopper cars is based on only two railroads, because these are the only roads having costs in a sufficient number of age groups to enable the proper use of index numbers.

Of the 23,957 hopper cars repaired 23,289, or 97 per cent, are of all-steel construction, there being only 668 repairs made to cars with composite bodies. These were all on railroad *Ia*. The inclusion of these composite body cars creates a distortion in the comparative costs in the different age groups on this railroad. It will be noted from Table V, that the cost in the 11-15-year group is $566 as compared with $220 in the 6-10-year group. The composite cars having a shorter repair interval (5-8 years) and a lower cost are found to a considerable extent in the 6-10-year group. The steel cars having a longer repair interval and a higher cost are for the most part in the 11-15-year group. This illustrates one of the fluctuations in costs not due to age.

The only important difference in the construction of

Freight Car Repairs in Relation to Age

Data on heavy repairs to 98,000 freight cars and rebuilding of 35,000 presented and analyzed in a report to the Railway Car Institute

THE study of the relationship between age and the cost of freight-car maintenance, based upon a detailed analysis of the freight-car maintenance costs and rebuilding programs of nine railroads, has been made for the American Railway Car Institute by Coverdale & Colpitts. Five of the railroads are in the eastern district, two in the southern and two in the western district. Some of them have a preponderating box-car ownership, while others are heavy coal carriers. One of the western railroads is a transcontinental line. In size, they range from a little over 1,000 miles to more than 10,000 miles of road. Detailed studies were made of repairs to box cars (including automobile cars), gondolas and hoppers. The following is an abstract of the report of the engineers to the American Railway Car Institute.

Heavy Repair Costs—Box Cars

The study includes data on heavy repairs to 98,147 freight cars on eight railroads during the period 1924-1934, the periods varying on the individual lines.

In the case of box and automobile cars we secured information on 47,460 heavy repairs on seven railroads. Eighty-six per cent of these cars were of 40-ton capacity.

Table I shows the average cost per car repaired for each of the seven companies, by five-year age groups. Although one might expect to find mounting costs in each succeeding age group, this is not always true because of differing repair and retirement policies. After freight cars reach a certain age (usually in the vicinity of 20 years) certain railroads place them in rough freight service which does not necessitate the heavy repair costs which would be required to put the cars in condition for high-grade loading. The effect of this policy is particularly noticeable on railroad *B* which makes a practice of giving no heavy repairs to cars when they have had 20 years service. It is natural that on this line highest cost per car should occur in the 16-20 year group.

Attention is also called to railroad *G* which includes box cars only in the 6-10-year group. In this instance there is a definite relationship between age and cost of repairs even within this age group, the cost per car for repairs being $245 for cars six years old; $397 for cars eight years old, and $456 for cars ten years old.

Because of the various reasons for differences in unit costs on the several railroads, it would be improper to combine the figures and obtain a composite cost per car repaired for all the lines involved. It is possible, however, to make a comparison between several of the roads by the use of index numbers.

On three of the seven companies shown in Table I the cars studied did not have a sufficiently long range in age to admit of establishing a trend. However, on the remaining four railroads the range in ages covered 25 years or more and it was possible to make comparisons by means of index numbers. Table II represents the trend on 35,605 heavy repairs, or 75 per cent of the total number of heavy repairs studied.

Effect of Box-Car Construction on Costs

Of the 47,460 box-car repairs studied 40,641, or 86 per cent, were on cars with steel underframes and only 14 per cent on cars with composite or wooden underframes. Only 13 per cent of the cars repaired had arch-bar trucks, the remainder having cast-steel side frames. The detailed figures showing comparative costs for cars

Table I—Heavy Repairs to Box Cars*—Cost Per Car Repaired at Various Ages

Road	Age groups, years	No. of cars repaired	Total cost	Average per car repaired
A	26–30	...	.....	...
	21–25	68	$5,287	$78**
	16–20	37	2,695	73**
	11–15	67	5,178	77**
	6–10	...	.....	...
	1–5	74	2,028	27**
	Total	246	$15,188	$62**
B	26–30	....	.....	...
	21–25	2,946	$1,102,039	$374
	16–20	5,663	2,333,013	412
	11–15	4,928	1,180,215	239
	6–10	7,156	820,116	115
	1–5	4,808	376,838	78
	Total	25,501	$5,812,231	$228
C	26–30	....	.....	...
	21–25	54	$36,736	$680
	16–20	3,807	2,611,280	686
	11–15	1,079	717,723	665
	6–10	....	.....	...
	1–5	....	.....	...
	Total	4,940	$3,365,739	$681
E	26–30	660	$447,989	$679
	21–25	663	438,260	661
	16–20	303	158,620	523
	11–15	1,073	605,623	564
	6–10	81	17,422	215
	1–5	....	.....	...
	Total	2,780	$1,667,914	$600
F	26–30	108	$50,503	$468
	21–25	411	155,794	379
	16–20	159	45,033	283
	11–15	62	15,175	245
	6–10	4,002	705,351	176
	1–5	2,336	343,052	147
	Total	7,078	$1,314,908	$186
G	26–30	....	.....	...
	21–25	....	.....	...
	16–20	....	.....	...
	11–15	....	.....	...
	6–10	2,986	$1,107,162	$371
	1–5	....	.....	...
	Total	2,986	$1,107,162	$371
I	26–30	....	.....	...
	21–25	....	.....	...
	16–20	....	.....	...
	11–15	1,395	$503,595	$361
	6–10	2,534	851,360	336
	1–5	....	.....	...
	Total	3,929	$1,354,955	$345

* Including automobile cars.
** Direct labor costs only.
Source: This information is based upon specific records in the offices of the railroad companies showing heavy repair costs by individual cars or series of cars.

of different types of underframe and trucks indicate that such differences in construction do not cause any material changes in the cost of heavy repairs when comparisons are made between cars in the same age groups.

Differences in the body construction, however, do cause differences in the repair costs. On two railroads which have cars of both steel-frame body and wooden body construction of the same age the costs for the cars with wooden bodies are somewhat greater per car repaired. Nevertheless, the same general tendency toward increasing costs with increasing ages is found in these figures as in the case of the table for all box cars.

Table II—Trend of Cost of Heavy Repairs Per Box Car Repaired, by Age Groups, Expressed in Index Numbers

Age group, years	Roads A	B	E	F
26–30	...	...	316	206
21–25	150	325	307	215
16–20	140	358	243	161
11–15	148	208	262	149
6–10	100	100	100	100
1–5	52	68	...	84

Table III—Heavy Repairs to Gondola Cars—Cost per Car Repaired at Various Ages

Road	Age groups, years	No. of cars repaired	Total cost	Average cost per car repaired
O	26–30	....	.....	...
	21–25	....	.....	...
	16–20	....	.....	...
	11–15	....	.....	...
	6–10	137	$38,497	$281
	1–5	157	23,393	149
	Total	294	$61,890	$211
P	26–30	....	.....	...
	21–25	13	$5,465	$420
	16–20	217	137,389	633
	11–15	....	.....	...
	6–10	....	.....	...
	1–5	....	.....	...
	Total	230	$142,854	$621
Q	26–30	....	.....	...
	21–25	200	$114,350	$572
	16–20	2,474	1,245,701	504
	11–15	286	157,818	552
	6–10	250	93,088	372
	1–5	....	.....	...
	Total	3,210	$1,610,957	$502
R	26–30	242	$81,724	$338
	21–25	95	26,244	276
	16–20	381	238,457	626
	11–15	542	169,770	313
	6–10	4,515	1,027,372	228
	1–5	2,198	273,860	125
	Total	7,973	$1,817,427	$228
S	26–30	28	$5,053	$180
	21–25	618	149,376	242
	16–20	267	61,492	230
	11–15	....	.....	...
	6–10	188	53,337	284
	1–5	....	.....	...
	Total	1,101	$269,258	$245
V	26–30	....	.....	...
	21–25	1,147	$147,147	$128
	16–20	1,974	230,746	117
	11–15	1,127	87,741	78
	6–10	7,469	498,390	67
	1–5	2,205	145,367	66
	Total	13,992	$1,109,391	$80

Source: This information is based upon specific records in the offices of the railroad companies showing heavy repair costs by individual cars or series of cars.

Gondola Cars

Our study of gondola-car repairs involved an analysis of unit costs for 26,730 cars on six railroads. Ninety-four per cent of the cars were 50-ton capacity. Table III shows the cost of heavy repairs per unit, the figures being shown by five-year age groups.

The normally expected higher repair costs for older cars are not as evident on this table as in the case of box cars. There are two principal reasons for this. The first is the same as the reason given under the discussion of box-car repairs; namely, that certain railroads as a matter of policy use their older cars in limited service and do not spend enough money in repairing them to put them into first-class condition. The second reason is that one of these lines, railroad *S*, has many old gondolas with wooden underframes and bodies. While these cars are repaired at much more frequent intervals, the cost for each heavy repair is considerably lower than on steel gondolas.

Table IV is an index table for heavy repair costs on gondola cars, similar to that for box cars. Only those railroads having a sufficient spread in age groups were used and railroad *S* was omitted because its costs for older cars are not comparable as explained above.

The heavy repairs on the above three railroads constitute 94 per cent of the total heavy repairs to gondolas studied.

Of the 26,730 gondola cars repaired 91 per cent had steel underframes and 85 per cent were equipped with cast-steel trucks. Most of the cars had wooden or composite bodies, there being only 3,440 cars with steel bodies, or 13 per cent of the total.

A restatement of the index tables shown above to give the differences in trends for all-steel cars as against composite cars can be made, as all of the cars on railroad *Q* are of all-steel construction, whereas the cars repaired on railroads *R* and *V* are all of composite construction.

Table IV—Trend of Cost of Heavy Repairs Per Gondola Car Repaired, by Age Groups, Expressed in Index Numbers

Age group, years	Roads Q	R	V
26–30	...	148	...
21–25	154	121	191
16–20	135	275	175
11–15	148	137	116
6–10	100	100	100
1–5	...	55	99

Hopper Cars

The number of hopper cars repaired in our study was 23,957. Of this number 85 per cent were cars of 50- or 55-ton capacity. Table V shows the cost per heavy repair to hopper cars on seven railroads by five-year age groups. The correlation between age and cost of repairs is more striking in the case of hopper than gondola cars, primarily because there are not so many differences in the construction of the cars. The index table for hopper cars is based on only two railroads, because these are the only roads having costs in a sufficient number of age groups to enable the proper use of index numbers.

Of the 23,957 hopper cars repaired 23,289, or 97 per cent, are of all-steel construction, there being only 668 repairs made to cars with composite bodies. These were all on railroad *Ia*. The inclusion of these composite body cars creates a distortion in the comparative costs in the different age groups on this railroad. It will be noted from Table V, that the cost in the 11-15-year group is $566 as compared with $220 in the 6-10-year group. The composite cars having a shorter repair interval (5-8 years) and a lower cost are found to a considerable extent in the 6-10-year group. The steel cars having a longer repair interval and a higher cost are for the most part in the 11-15-year group. This illustrates one of the fluctuations in costs not due to age.

The only important difference in the construction of

hopper cars is in the trucks, 14,351, or 60 per cent, of the 23,957 cars being equipped with cast-steel sideframes and the balance with arch-bar trucks. Two railroads, *Ga* and *Ka*, had repairs made to both kinds of equipment. The unit costs are shown in Table VII.

Interval Between Heavy Repairs

Because of the differing policies pursued by various companies the interval between heavy repairs to freight cars varies considerably as between railroads and also between the different classes of equipment. Many of the lines put their cars in the backshop for heavy repairs every six or seven years; others bring the cars in more frequently, one railroad using a four-year interval as a definite plan. This results in a considerably lower cost per car repair, but, of course, the number of heavy repairs given a car during the course of its life is considerably greater when this policy is pursued. Another road studied brings its cars in every three years. At the end of the first three years the car gets a light repair; at the end of the sixth year it is given a medium repair, and at the end of the ninth year a heavy repair.

In the case of gondola cars the repair period varies to an even greater extent. Several of the lines studied have older gondola cars with either wooden or composite bodies. In the case of such equipment we found that heavy repairs were made at much more frequent intervals, but that the cost per repair was, as might be expected, considerably lower than in the case of steel gondolas being repaired every seven or eight years. On one railroad the repair interval on older gondolas was as low as two years.

Although the difference in the repair interval has a very important effect on a comparison of repair costs on different railroads it does not affect the comparison of costs by age groups on an individual railroad where the same repair interval has been in effect on cars of all ages.

Table V—Heavy Repairs to Hopper Cars—Cost Per Car Repaired at Various Ages

Road	Age groups, years	No. of cars repaired	Total cost	Average cost per car repaired
Fa	21–25	....	.....	...
	16–20	312	$110,462	$354
	11–15	138	50,797	368
	6–10	....	.....	...
	1–5	....	.....	...
	Total	450	$161,259	$358
Ga	21–25	248	$128,407	$518
	16–20	2,856	1,368,650	479
	11–15	845	394,773	467
	6–10	350	121,769	348
	1–5	....	.....	...
	Total	4,299	$2,013,599	$468
Ia	21–25	....	.....	...
	16–20	....	.....	...
	11–15	477	$270,008	$566
	6–10	519	113,976	220
	1–5	....	.....	...
	Total	996	$383,984	$386
Ja	21–25	....	.....	...
	16–20	....	.....	...
	11–15	831	$193,424	$233
	6–10	222	29,259	132
	1–5	1,197	146,054	122
	Total	2,250	$368,737	$164
Ka	21–25	300	$147,130	$490
	16–20	5,292	2,313,701	437
	11–15	8,335	3,500,529	420
	6–10	1,554	545,418	351
	1–5	....	.....	...
	Total	15,481	$6,506,778	$420
La	21–25	20	$10,380	$519
	16–20	156	88,299	566
	11–15	16	7,590	474
	6–10	....	.....	...
	1–5	....	.....	...
	Total	192	$106,269	$553
Ma	21–25	....	.....	...
	16–20	....	.....	...
	11–15	289	$121,958	$422
	6–10	....	.....	...
	1–5	....	.....	...
	Total	289	$121,958	$422

Source: This information is based upon specific records in the offices of the railroad companies showing heavy repair costs by individual cars or series of cars.

Light Classified Repairs and Light or Running Repairs

The so-called light classified repairs are usually made between heavy repairs and at a cost averaging between $25 and $150 per car repaired. On the one railroad where we found records of such cost by individual cars we found that the expense per box car was between $25 and $100; for gondolas, between $40 and $80, while the range for hoppers was $40 to $100.

More information as to light and running repair costs was developed than was possible for light classified repairs. In the case of two lines we were able to obtain data as to running repair costs for box cars, these records being based on a certain number of units in each series. On one railroad information was available for 25 cars in each series, while on another information was obtained for 10 units in each series. Table VIII shows the average cost per car per year for running repairs for these two companies for equipment of different ages.

Table VI—Trend of Cost of Heavy Repairs Per Hopper Car Repaired by Age Groups, Expressed in Index Numbers

Age group, years	Roads	
	Ga	*Ka*
21–25	149	140
16–20	138	125
11–15	134	120
6–10	100	100

Table VII—Average Cost of Heavy Repairs Per Car

Age group, years	Road *Ga*		Road *Ka*	
	Cast-steel trucks	Arch-bar trucks	Cast-steel trucks	Arch-bar trucks
21–25	...	$518	...	$490
16–20	...	479	$450	428
11–15	$450	488	420	422
6–10	349	342	351	...

In the second and third groups, which cover the depression years, the running repair costs generally are lower than those in the first group. Cars were not in service as much of the time during the depression years and more pressure was being exerted to reduce expenses to the lowest point.

Running repair costs for gondola cars, shown in Table IX, were obtainable on only one railroad. The average costs are based on the records of 25 cars in each series.

The effect of the depression years on expenses is obvious. Certain information which was made available also indicates that the frequency of visits to the rip tracks increases with the age of the equipment.

Rebuilding Programs

It has been the practice on many railroads to rebuild cars when they reach an age of between 15 and 20 years. In the case of six of the companies from whom information was obtained we found that details regarding such rebuilding programs were compiled. The cost data

for such reconstruction covered a total of 35,358 cars. On three of the lines the costs were secured by individual cars, while on the other three the data were available by series of cars. The period in which these programs were carried out extended from 1919 to 1931, inclusive. The average rebuilding cost per car on various railroads is shown in Table X.

An attempt was made to determine whether any relationship exists between the age of the car and the cost of rebuilding, but sufficient data were not available because, generally speaking, the cars were in the same age group. Eighty per cent of the rebuilt cars included in our study were reconstructed between the fifteenth and twenty-first year of life.

In addition to the cost figures information was obtained as to age at time of rebuilding, service life restored and age of retirement of both rebuilt and non-rebuilt cars in the same series. Such data were secured for 24,755 rebuilt cars and 32,976 units of equipment which were not reconstructed. In addition, there were 13,621 cars rebuilt, for which we were able to obtain the age at time of rebuilding, but for which the records as to retirement were not available. The analysis of these results appears in Table V.

The study of rebuilding costs for box cars includes 28,039 units of equipment on five railroads. The average cost of rebuilding (see Table X), excluding re-used material, was $1,487. In the study made to determine the age of cars at time of rebuilding and the results obtained, expressed in terms of service years restored (see Table XI), we obtained data on a total of 31,305 box cars. As to the years of service restored by the rebuilding of the cars, complete data were not obtainable. For all cars for which records were available the average life restored was 9.3 years. In the case of the two companies where the most complete data were secured (covering 85 per cent of the cars rebuilt), the service life added was 7.2 years and 8.9 years, respectively.

Rebuilding costs were obtained for 7,319 gondola cars on four railroads. The average cost of reconstructing these cars, excluding reused material, was $1,196. Excluding the rebuilding carried on prior to 1924, the average cost per car was $1,249. Age data were secured for 7,071 gondola cars.

We were unable to obtain adequate information on the rebuilding of hopper cars. Some figures which were available on one railroad indicated that the cars were less than 14 years old at time of rebuilding. Furthermore, retirement records were available on only 25 per cent of the total cars rebuilt. For this reason no further analysis has been made of the rebuilding of hopper cars.

Table VIII—Running Repair Costs for Box Cars

	Age of cars during the period	Average cost per car per year
1928-1930, inclusive, Road No. 1	21–23	$51
	20–22	61
	18–20	47
	9–11	37
	1	1
1931-1933, inclusive, Road No. 1	24–26	$35
	23–25	30
	21–23	38
	12–14	35
	1–4	15
1930-1932, inclusive, Road No. 2	21–23	$39
	17–19	37
	12–14	33
	11–13	30

Table IX—Running Repair Costs for Gondola Cars, Road No. 1

	Age of cars	Average cost per car per year
1928-1930, inclusive	18–20	$35
	14–16	33
	1	7
1931-1933, inclusive	20–22	$21
	16–18	21
	1–4	10

Effect of Construction on Rebuilding Costs

A study was made to determine the relationship, if any, between the rebuilding costs and the original construction of such cars, and, in addition, whether changes made concurrently in the construction of the body, underframe and trucks affected the costs.

In the case of box cars we found that on roads Nos. 1 and 3 the units rebuilt were all of the same construction. On road No. 2, with an average cost of $1,319, the highest expense ($1,409) occurred in the case of steel underframe wooden cars with arch-bar trucks, the construction of which was not changed. The lowest cost ($1,297) applied to cars of the same original construction which were rebuilt with composite bodies in place of wood. In the case of road No. 5 a similar condition was found, the highest expense of $1,240 resulting from the reconstruction of wooden cars with wooden underframes and arch-bar trucks with no change in design. The lowest cost of $1,103 resulted from the rebuilding of steel underframe wooden cars with cast-steel trucks, the bodies being changed to composite. On one road, No. 4, the expenses ran slightly higher in instances where a change was made from arch-bar to cast-steel trucks, the costs in such cases generally being from 3 to 8 per cent higher per car than in the case of units rebuilt without change in the original construction.

Likewise, in the case of gondolas the variation in costs because of different construction of cars had little effect on the average costs. Changes in the construction of equipment incident to the rebuilding sometimes made the costs higher and, in other instances, lower than the average costs for units not undergoing changes in the original construction of the underframe, body or trucks.

Table X—Average Rebuilding Costs of Freight Cars, Excluding Cost of Re-used Material

Railroad	Cost per car
Box Cars	
1	$1,474
2	1,319
3	1,200
4	1,689
5	1,217
Total	1,487
Gondola Cars	
X	$1,035
Y	937
Z	1,291
W	1,359
Total	1,196

Table XI—Retirement and Rebuilding Ages of Cars and Service Life After Rebuilding

	Rebuilt Cars			Non-Rebuilt Cars
Railroad	Age at time of rebuild.	Service life added by rebuild.	Age at retirement	Age at retirement
Box Cars				
1	15.7	7.2	22.9	22.7
2	18.9	...	...	20.2
3	18.2	10.1	28.3	26.2
4	16.5	12.2	28.7	21.5
5	16.9	8.9	25.8	21.4
Total	17.6	...	...	22.3
Total, exclud. No. 2	16.8	9.3	26.1	23.3
Gondola Cars				
X	17.4	7.5	24.9	19.2
Y	15.0	...	...	...
Z	20.0	11.7	31.7	29.5
W	18.6	...	...	...
Total	18.4	...	...	...
Total, exclud. *Y* and *W*	18.6	8.7	27.3	22.7

Joel S. Coffin, Outstanding Railway Supply Trade Executive, Dies

Regarded as one of the industry's progressive and constructive leaders, he exercised an important influence on the development of the modern steam locomotive

JOEL STEPHEN COFFIN, or Joe Coffin, as he was more familiarly know in the railway world, died at Miami Beach, Fla., on Monday, March 11. He was identified with the railway and railway supply business throughout his entire business life and for the past quarter century has been regarded one of the most progressive and constructive leaders in the railway supply industry. The group of companies with which he was associated have specialized largely upon the steam locomotive and its appurtenances, and it is not too much to say that these particular companies, through their activities in research and the development of new designs and devices, as well as their promotion and servicing, have played a leading part in the remarkable development of the modern steam locomotive. Mr. Coffin had the ability to surround himself with strong executives and engineering experts of unusual ability.

Joel Stephen Coffin

Mr. Coffin was born in 1861 in Wales Township, St. Clair County, Mich., and his boyhood was spent in Elm Hall, Mich. His father was born in New Hampshire, his forebears being among the early settlers of Nantucket Island. His mother was born in Michigan. At 18 years of age Mr. Coffin became a machinist apprentice in the shops of the Chicago & West Michigan Railroad at Muskegon, Mich. He left that occupation, apparently before he completed his apprenticeship, in order to become a locomotive fireman and then a locomotive engineer on the same road. In 1885 he entered the service of the Wisconsin Central Railroad as a locomotive engineer, and in 1890 was promoted to road foreman of engines on that road.

Became Associated with Supply Industry in 1892

In 1892 Mr. Coffin entered the employ of the Galena Signal Oil Company, as a member of its mechanical expert staff. He was advanced to the position of manager of that department in 1895, and in 1907 was elected vice-president of the company. He resigned in 1909 to become a vice-president of the American Brake Shoe & Foundry Company, with headquarters in New York.

Meanwhile, in 1902, while with Galena Company, he, with Samuel G. Allen, who has been associated with him ever since, organized the Franklin Railway Supply Company. In 1910, while with the American Brake Shoe & Foundry Company, he organized the American Arch Company. He also took an active part in the development of the Locomotive Superheater Company.

In 1911 he resigned from the American Brake Shoe & Foundry Company, to devote his entire time to the Franklin Railway Supply Company, the American Arch Company, the Locomotive Superheater Company, and other companies which later became associated with these organizations. In 1916 he became chairman of the board of the Lima Locomotive Works, Inc.

At the time of his death Mr. Coffin was chairman of the board of the American Arch Company, the Franklin Railway Supply Company and the Lima Locomotive Works, Inc. He was chairman of the executive committee of the Superheater Company and a director of the American Brake Shoe & Foundry Company, the G. M. Basford Company, the Locomotive Feedwater Heater Company, Rome Iron Mills, Inc., the Venango Manufacturing Company, and other organizations.

Took Keen Interest in Civic Affairs

Mr. Coffin took great pride in retaining his membership in the Brotherhood of Locomotive Engineers. He lived in Englewood, N. J., and took a keen interest in civic affairs. He is survived by his widow, Mrs. Harriet Delilah Coffin, and two sons, Charles William Floyd Coffin, vice-president of the Franklin Railway Supply Company, and Joel Stephen Coffin, president of the J. S. Coffin, Jr., Company.

THE 1935 ROADWAY-REHABILITATION and equipment-building program of the London, Midland & Scottish of Great Britain contemplates an expenditure of approximately $46,000,000 according to a recent announcement by T. R. Dester, general traffic manager, Associated British Railway, Inc., New York. The program includes the construction or rebuilding of 287 locomotives, 627 passenger cars, 10,050 freight cars and two steamships; also track and roadway work will be carried out on 600 mi. of line.

A. R. E. A. Holds Three-Day Convention

J. E. Armstrong
President

Expanded program provides increased time for presentation of committee reports — Ends period of curtailed sessions

R. H. Ford
President-Elect

IF there were any doubts in the minds of the officers and directors of the American Railway Engineering Association as to the wisdom of their decision to revert to the three-day program at the thirty-sixth annual convention, after four years of curtailed activity, they were definitely allayed on Tuesday morning of this week when the first session was called to order by President John E. Armstrong, assistant chief engineer, Canadian Pacific. More than 450 members and guests were assembled in the Grand ball room of the Palmer House, Chicago, and with the many important subjects scheduled for presentation by the association's 28 regular and special committees, active interest was maintained throughout the six sessions on Tuesday, Wednesday and Thursday.

No evening sessions were held, as it was the feeling of the board of direction that the members should be given ample time to visit the exhibit presented by the National Railway Appliances Association at the Coliseum during the course of the convention. In lieu of the annual banquet, which was abandoned following the convention in 1931, the association joined with the N.R.A.A. in a luncheon on Wednesday noon, followed by an address by William Baird, steamship passenger traffic manager, Canadian Pacific, on "A Steamship Outlook."

M. J. Gormley Addresses the Convention

M. J. Gormley, executive assistant to the president of the A.A.R., reviewed the present status of the legislative program of Congress insofar as it affects the railroads and outlined some of the plans of the Association of American Railroads at the Wednesday morning session. He referred in particular to the proposal for federal regulation of highway and waterway transport which has been endorsed by the Interstate Commerce Commission, by the commissions of most of the states—in fact, by almost everyone, he said, with the exception of the truck manufacturers.

E. H. Fritch
Secretary

No one is more closely identified with the A.R.E.A. than its secretary, who has served in that capacity for 29 years.

Among other bills that are of vital concern to the railroads are those being fostered by the leaders of the railroad brotherhoods. He referred specifically to the six-hour day bill which, according to careful estimates will result in an increase in operating expenditures for the railroads of about 600 million dollars per year. The full-crew bill, the train-limit bill and the bill for the governmental inspection of bridges and tracks will increase this amount to the point where it is estimated, he said, that the combined effect would increase the operating expenditures of the railroads by a billion dollars a year, an amount equal to the saving in operating expenditures that the railroads have effected by reason of improvements in operating efficiency and the capital expenditures made since 1920.

Touching on the president's program for unemployment relief through the agency of a "blank check" for 4,800 million dollars, Mr. Gormley pointed out that the railroads have an interest in the outcome insofar as it concerns the possibility of federal appropriations for grade separation.

With respect to the plans of the Association of American Railroads, Mr. Gormley referred to the progress being made in the organization of research, citing the appointment of L. W. Wallace as director of mechanical research. Plans for the organization of a construction and maintenance research department have not yet been completed and this is true also with respect to the appointment of a director of scientific research, and until action has been taken with respect to these two projects it will be impossible to determine whether the railroads will pursue their research programs through the cooperation of existing laboratories or through the establishment of a laboratory of their own.

Of equal importance in Mr. Gormley's opinion is the plan for the pursuit of intensive traffic research as a

means of ascertaining the reasons for the loss of business to other transport agencies, consideration being given also to the conduct of a study of the inter-relationship between rail transport and the problems of agriculture. Taken as a whole, he said, these various projects comprise an ambitious program which introduces so many problems that it will take time to arrive at a satisfactory solution of all of them.

While the various sessions of the convention were occupied primarily in the consideration of the reports of committees, the subject that engaged primary attention this year, was the outlook of the association under the sponsorship of the Association of American Railroads which had been brought into being since the last A.R.E.A. convention. This was the primary theme of President Armstrong's address on Tuesday morning, in which he made five specific suggestions for changes in organization and procedure, which in his opinion would increase the effectiveness of the association's work and its usefulness to the railways as a whole in meeting the many routine and special problems confronting them.

The report of Secretary E. H. Fritch, showed a membership enrollment of 1,903, while the report of the treasurer indicated total assets of $79,187.93, a gain of $3,795.32, during the year. The registration totaled 619 members and 288 guests, a total of 907, as compared with a registration of 510 members and 198 guests last year.

New Officers

At the concluding session on Thursday afternoon the following officers were declared elected and installed: President, Robert H. Ford, assistant chief engineer, C. R. I. & P., Chicago; second vice-president, J. C. Irwin, valuation engineer, B. & A., Boston, Mass.; secretary, E. H. Fritch; treasurer, A. F. Blaess, chief engr., Illinois Central, Chicago. Directors: Ralph Budd, president, C. B. & Q., Chicago; Bernard Blum, chief engineer, Northern Pacific, St. Paul, Minn.; W. T. Dorrance, asst. to chief engineer, N. Y., N. H. & H., New Haven, Conn. In addition, A. R. Wilson, engineer bridges and buildings, Penna., Philadelphia, was advanced automatically to first vice-president.

President Armstrong's Address

During the past twelve months, from the viewpoint of this association, three significant things have happened; the association of American railroads has been formed; there has been a further awakening to the fact that there is a transportation problem of which the railway problem is but a part; and both the average and the maximum speed of railway transportation has been increased.

The Association of American Railroads is a federation of the railways. To it has been delegated more authority than ever before has been delegated so unanimously by the individual railways. It is expected that in due course it will speak authoritatively for the railway industry of the United States, if not for the railway industry of the continent. Much is expected of it. If it is to fulfill these expectations it must have the wholehearted co-operation and support of every branch of the railway industry. The American Railway Engineering Association, as one of the branches of the railway industry, must make such changes in the details of its organization and in its method of working as may be found necessary to enable it to give the greatest possible support to the Association of American Railroads.

Continuing consideration of the transportation problem will undoubtedly require that the railways develop a great deal of information which is not now available. From the engineering point of view this information will have to do, among other things, with the actual total costs involved in providing, conducting and maintaining the various forms of transportation, and with their relative economy for the type of service required in any given case. A start has been made in the development of some parts of this information, but no organization or collaborating group of organizations seems to be prepared at this time to state all the facts. The American Railway Engineering Association is in a position to develop these facts in so far as they pertain to railway transportation, and must be prepared to consider critically the corresponding presentations of other forms of transportation or, if necessary, to prepare such presentations if they are not otherwise made available.

Effect of Increased Speeds

Transportation speeds have increased persistently and railway transportation has not lagged in this respect. Increasing railway speeds are opening new vistas for engineering research. The increasing average and maximum speeds of standard passenger and freight trains, the high average and maximum speeds of streamlined lightweight passenger trains, and the high average and maximum speeds in immediate prospect for streamlined standard passenger trains are creating immediate problems and giving hints of others to come. Appropriate studies by this association of the various present and prospective engineering and maintenance problems resulting from higher speeds are essential, and must be borne in mind in the assignments in its committees.

The railways recognize that what was good enough in the days of a virtual railway monopoly of transportation is not good enough in these days of competition in transportation. They ask of government a fair field and no favor in the transportation industry as a whole. They demand of themselves the production of railway passenger and ton miles at a lower overall cost per unit, and at the same time of a type more attractive to their patrons.

Prior to the beginning of this century highway transportation moved normally in a cloud of dust or through a sea of mud. A highway journey of fifty miles in one day was an event to be well planned in advance, and made under selected conditions of weather and roadway. Today a comfortable highway jaunt of four hundred miles between breakfast and dinner is not unusual. Highway and automotive engineers have made this change possible.

A Wide Field for Research

The railway industry is entering upon a period of evolution which in magnitude and in speed of accomplishment should surpass that of the past 35 years in highway transportation. The problems it has to solve are mainly engineering ones. The railway engineer has before him as wide a field for research and improvement as the highway and automotive engineers had at the beginning of the century. If he is to make the most of his opportunities he must press on with his studies for improving and at the same time reducing the cost of railway transportation. He must solve immediate problems, must anticipate and solve impending problems and at all times must be forearmed with facts and prepared to act promptly as occasion demands.

The principal reason for the existence of this association is the assistance which, by the concerted action of its membership, it can give to the individual railway engineer and to the railways. In so far as it has fulfilled this purpose it has prospered. As long as it is the most efficient agency for securing required engineering information and results it will continue to prosper, for it will be supported, not only by its own membership, but by the railways which reap the benefits of the work it does.

Conditions affecting the railway industry have changed. The organization and methods of the railway industry are changing. The next few years promise greater changes in the railway industry than have occurred in any similar past period of time. The American Railway Engineering Association must keep abreast of the industry it serves, and should lead and direct the engineering thought and action of that industry. To accomplish this it must be sure that its own organization and methods are the best possible for handling accurately and promptly the problems with which it is and will be confronted.

To this end I recommend for appropriate consideration:—

(1)—That the organization and method of procedure of the American Railway Engineering Association be surveyed with a view to making such changes in them as may be found desirable

to enable the association to be of the greatest possible assistance to the railway engineer and to the railway industry;

(2)—That in the light of the present and prospective demands upon this association, the entire field of railway engineering and maintenance be subdivided anew into definitely defined parts, and that each part so determined be placed for study in the responsible charge of an appropriate committee;

(3)—That the present committees be retained, rearranged, merged with other committees or disbanded according to the requirements of this new partitioning of the field of railway engineering and maintenance;

(4)—That the resulting committees be so organized that they will be prepared to handle both regular and special assignments with the greatest possible accuracy and despatch; and—

(5)—That the Manual be so revised and rearranged that all present and future information properly appearing in it can be quickly and easily found under appropriate subject headings.

Economics of Railway Location

F. R. Layng, Chairman*

The committee gave consideration to six subjects during the year, but presented reports on only the two referred to below.

Ruling Grades Lighter than 0.4 Per Cent—On two earlier occasions the committee has presented reports on the relative merits of ruling grades lighter than 0.4 per cent in the light of modern operating requirements. In its present report, the committee presented a digest of its earlier report, setting out the main features contained therein, and then submitted a group of conclusions, which it offered as information with the recommendation that the subject be discontinued. The conclusions offered follow:

(1) No definite formula can be given for the relative merits of a 0.4 per cent ruling grade as compared with a 0.3 per cent grade. Each operating division is a separate problem to be analyzed on the conditions and traffic on the division.

(2) The primary advantage of the lighter grades is the weight of trains which can be handled.

(3) While there may be a limit below which it is not economical to reduce grades on account of starting resistance, the general opinion, based perhaps more on observation than upon actual tests, seems to be that 0.2 per cent is that limit.

(4) The average speed of trains over the road is one of the factors to which weight must be given in any grade reduction study.

(5) The experience of a number of roads operating with ruling grades from 0.2 to 0.3 per cent shows favorable results.

(6) A speed-time profile is recommended as the best method of comparing speed, time and fuel consumption.

(7) Decision to adopt any ruling grade should be based on a careful survey of present conditions, a forecast of future conditions and careful computations of the cost and the savings to be effected.

Increasing Tonnage by the Reduction of Grades or by Use of Locomotives with Increased Tractive Power—Following a review of the three reports which it has made on this subject in the past, which it presented under the heads of:—(1), to what extent is the problem an alternative?; (2), relative ease or difficulty of obtaining the necessary money; (3), factors to be considered; (4), method of analysis; and (5), expenses reduced to a unit cost; the committee presented the following conclusions, which were offered as information with the recommendation that the subject be discontinued:

(1) It is impossible to formulate any general rule which will afford a comparison of the relative merits of the above methods of increasing tonnage.

(2) In certain cases both methods may be resorted to simultaneously to advantage.

(3) Decision to adopt either or both methods should be based on a careful survey of present conditions, a forecast of future conditions, and careful computations of the cost of installation and the savings to be effected on each alternate plan. All the possible factors listed in this report should be considered and their effects reflected in such computations, which should be reduced to an appropriate unit cost basis.

(4) The relative ease of obtaining the necessary funds for heavier power under the "Equipment Trust" plan may be the deciding factor, although it has no bearing on the relative merits from an engineering standpoint.

Other Subjects—Without submitting written reports, the committee stated that it had made progress in the study of its other assignments as follows:

Revision of the Manual; review previous reports on the economics of grade revision as affected by electric operation; compile operating data essential to establish units for making line and grade revisions to meet operating requirements; and proper size and character of field organization for railway location and construction.

This report was accepted without discussion.

* Chief Engineer, Bessemer & Lake Erie.

Report on Yards and Terminals

M. J. J. Harrison, Chairman*

The committee presented detailed reports on six of its nine assignments and recommended additions to the Manual in connection with the subjects on grain elevator storage yards and scales used in railway service.

Revision of Manual—The committee recommended for adoption a revised definition for "terminal" which is more inclusive than the definition appearing in the Manual, and also recommended deletion from the Manual of the diagram track layout of a stub passenger station appearing on page 961, which recommendations were adopted.

Grain Elevator Storage Yards and Tracks—As a part of its 1934 report, the committee presented an analysis of replies received to a questionnaire which had been sent to 47 railways. This year's report was largely a condensation of the 1934 report, and included a series of suggestions and recommendations, which were offered for adoption and inclusion in the Manual. The recommended material was presented under the following heads: Grain elevator storage yards and plant tracks; grain elevators—general types; elevator plant tracks; and storage yard. Following discussion concerning the wording of the report, the committee agreed to review the suggestions made from the floor and embody them in its report next year. This report was then adopted for inclusion in the Manual.

Co-ordination of Facilities at Rail and Water Terminals—The committee began its investigation of this subject in 1929. At that time, a questionnaire covering 162 items and designed to determine the current practice in the construction and operation of facilities at rail-water terminals, was submitted to more than 100 railways of the country. The present report of the committee was essentially a resumé of the 87 replies received to the questionnaire, and was presented under the following heads: General; ownership and operation; slip capacity and maintenance; open storage; merchandise piers; coal piers; ore docks; oil and gasoline docks; car ferry or car float slips; other docks; warehouses; grain elevators; industrial developments; rail terminal facilities; and roadways and highways. For the purpose of analysis, the data were classified according to public and private ownership, and ocean, lake and river ports. The report on this subject was received as information.

Scales—As a part of its 1934 report, the committee recommended deletion from the Manual of the material appearing under the title "Specifications for the Manufacture and Installation of Motor-Truck, Built-In, Self-Contained and Portable Scales for Railway Service," and submitted as information a somewhat different set of specifications under the same title with the recommendation that the new material serve ad interim the purpose of the material which it recommended be deleted. Both of these recommendations were approved. During the last year the committee critically reviewed the specifications submitted as information in its 1934 report, and, as a result, presented these specifications in its present report, with certain recommended changes, for approval and publication in the manual. The specifications are drawn up under the following main heads: Introduction; information to be supplied by purchaser; classes of scales; capacities and sizes; plans; working stresses and formulas; particulars of loading; scale levers; pivots and bearings; nose irons; loops and connections; lever fulcrum stands; checks; weigh-beams and accessories; anti-friction points and

* General Scale Inspector, Pennsylvania.

plates; clearances; factory adjustments; interchangeability; sensibility reciprocal (S.R.); performance requirements; location and elevation; foundations; scale beam house or box; installation; platforms; light, drainage and foundation; entrance to scale pit; and protection from corrosion.

J. B. Hunley (C. C. C. & St. L.) raised a question as to the method of scheduling stresses in the individual members of the scale assembly and considerable discussion of this method followed, without action. The specifications were then adopted.

Effect of Freight Handling by Motor Trucks on Freight-Terminal Design—Collaborating with the Committee on Economics of Railway Operation, and with the Motor Transport division of the Association of American Railroads, the committee made a thorough study of the new problems involved in connection with the location and layout of freight terminals as a result of developments in handling freight by motor trucks. As a result of this study, it reached a series of conclusions which it presented as its report. In these conclusions it stated that the motor truck transportation industry is in an unstable condition; that it suffers particularly from a wide diversity of ownership and operation among a large number of small and medium-size operators; that there is a lack of uniformity in regulation and taxation in the various states; that there is a trend toward greater standardization of equipment and more complete regulation; that some form of federal regulation is expected in the near future; and that substantial changes in the motor truck transportation industry are expected to follow any changes in regulation.

In view of the situation found by the committee, it recommended that the subject be discontinued, and that no changes be made in the present material appearing in the Manual. The conclusions were accepted as information.

Bibliography—As a part of its report the committee presented a bibliography of published articles, papers and books dealing with passenger stations and terminals; freight stations, terminals and yards; rail-and-water terminals; and coal handling at ports.

Other Subjects—The committee reported progress in its study, with collaborating committees, of its three other assignments dealing with hump yards, the expediting of freight car movements through yards, and coal transfer terminals.

Uniform General Contract Forms

F. L. Nicholson, Chairman*

Collaborating with other committees, the committee advanced its work during the year to the point where it was able to present three contract forms for adoption and inclusion in the Manual. In addition, it reported progress in the development of two other forms of agreement. No revisions in the Manual were recommended.

Form for Right to Construct and Maintain Buildings Over Railway Property—Last year the committee submitted as information a carefully prepared form for the conveyance of title granting the right to construct and maintain buildings over railway property. This form, which takes into consideration all of the factors which may normally arise between the grantor and the grantee, and, in addition, special conditions which may apply in specific cases or in certain localities, was presented this year for adoption and publication in the Manual. This recommendation was accepted.

Form of Agreement with Public Authorities for Highway Grade Crossing Elimination or Separation—As the result of two years' study in collaboration with the Committee on Grade Crossings, during which time many agreements were carefully analyzed, the committee, presented as information at the 1934 convention, a form of agreement which covers both overhead and underpass grade separations.

This year the committee presented another form on this subject for inclusion in the Manual but later withdrew this recommendation and requested that the subject be continued.

Form for Pipe Line Installations on Railway Property—This subject was assigned to the committee in 1931, and during the last several years it has had a number of conferences with the Central Committee on Pipe Line Transmission of the American Petroleum Institute in an attempt to draft a form of agreement that would be satisfactory to both bodies. In its present report, the committee stated that agreement with the committee of the Petroleum Institute seemed impossible of attainment. It therefore submitted a form of agreement of its own formulation, which it recommended be adopted and included in the Manual. The form was accepted.

Form of Agreement for Rail-Air Service—In a short progress report, the committee reviewed the progress of long distance rail-air service, which was established in 1929 when the Transcontinental Air Transport Company, the Pennsylvania and the Santa Fe provided a coast to coast service. It pointed out that with the increased cruising speed of airplanes and the construction of lighted airways, permitting more night flying, rail-air service has progressively declined. It also pointed out that there is little or no occasion for the joint use of facilities in such service, and no case of joint use of facilities by airways and railways at the present time. In view of this situation, it recommended that the assignment be discontinued.

Other Subjects—The committee stated that it is co-operating with a subcommittee of the Western General Managers Association in the preparation of a form of agreement for use in connection with store door freight delivery service, but that it is not ready to submit a form. It reported progress in the preparation of a form of agreement for cab stand privileges.

* Chief Engineer, Norfolk Southern.

Economics of Railway Operation

J. E. Teal, Chairman*

The committee made detailed reports on only two subjects this year, but reported progress in its study of seven other subjects.

More Intensive Use of Railway Facilities—In past years this committee has given primary study to the effects of various changes in operating conditions upon freight train performance and the extent to which these changes increased the traffic capacity of the railway. This year it gave consideration to the co-ordination of facilities, and based its report on a study of the economies resulting from the use of 8.6 miles of single-track of one road for the handling of the traffic of another road in addition to its own, resulting in the abandonment and removal of 8.6 miles of single track of the other road.

Following a detailed analysis of all of the factors involved, including the division of costs and savings, the committee offered the following conclusion: Where the volume and distribution of traffic at certain locations or over certain parallel sections of roads are such that same can be handled economically over the facilities of one road, co-ordination of facilities should be considered.

This report was criticized by J. E. Willoughby (A. C. L.) because it did not specify how the rights of security owners were to be safeguarded in connection with the removal of the property involved in the abandonments. G. S. Fanning (Erie), replied that the value of property would be charged to profit and loss, and M. F. Mannion (B. & L. E.), the subcommittee chairman who presented the report, contended that the status of the security holder was definitely improved by reason of the savings effected, regardless of what happened to the property affected. R. H. Ford (C. R. I. & P.) suggested that the committee undertake the study of projects of larger scope—for example—the disposition of the Minneapolis & St. Louis, because of the greater diversity of problems that would be introduced.

Most Economical Train Length—Because of the interest shown in the performance of oil-electric locomotives and rail cars, the committee this year gave consideration to these units of equipment, supplementing its study last year of the capacity of steam locomotives. In order that the data pertaining to both types of motive power might be available in one place for future reference and for ready comparison, the committee, in its present report on the capacity of oil-electric equipment, included in revised form much of the material presented in last year's report with regard to steam locomotives. The body of its report was presented under the following subject heads: Typical steam locomotives, tenders for steam locomotives, potential horse-

* Special Engineer, Operation, Chesapeake & Ohio.

power capacity of typical steam locomotives, speed-tractive-effort curves for steam locomotives, oil-electric locomotives and rail cars, speed-tractive-effort curves for oil-electric locomotives, and oil-electric rail cars.

After some criticisms of the complexity of some of the formulas presented, the report was received as information with a suggestion from President Armstrong that the committee prepare information for inclusion in the Manual in its next report.

Revision of the Manual—During the year the committee made a critical review of all of the material in the Manual pertaining to the economics of railway operation, and while many suggestions for revisions were considered, it reported that it had not had opportunity to formulate any definite recommendations.

Other Subjects—The committee reported progress in its study of the following subjects: Methods or formulae for the solution of special problems relating to more economical and efficient railway operation; analyses to determine when a railway or branch line should be retired; the effect of volume of traffic on railway operating expenses, collaborating with the Committee on Economics of Railway Labor; operation with a reduced number of main tracks; train resistance as affected by weights of rail, collaborating with the Committee on Rail; and the economic limits of the movement by the railway of freight from shipper to receiver, by rail, by highway or by a combination of both, collaborating with the Committees on Highways, and Yards and Terminals, and with the Motor Transport division.

Economics of Railway Labor

F. S. Schwinn, Chairman*

In a report covering six subjects, the committee offered a complete revision of all of its material appearing in the Manual, and a comprehensive study of gang organizations for surfacing track in stone ballast.

Revision of the Manual—During the year the committee reviewed critically the material in the Manual which had been adopted on its recommendation over the period of the last 16 years, and found that, as the result of changing conditions and changes in personnel, the various groups of conclusions or recommended practices were lacking in continuity and coherence, and overlapped or conflicted in numerous respects. In certain instances, some of the conclusions had become obsolete.

In view of this situation, the committee, without adding new material, revised and co-ordinated its material in the Manual in order that this material might represent a coherent and up-to-date statement of the conclusions to which the association has given its approval. All of the changes involved in this revision of material were detailed in the committee's report and were adopted.

Operations of Roads That Have Greatly Reduced Labor Requirements—In 1929 the committee made a trip over the Lehigh Valley, observing maintenance methods and investigating labor and material records. Its findings were made the subject of reports in 1930 and 1932. The committee made a second trip over this road in 1933, and its present report, which is based on its findings on this second trip, is essentially an extension of its earlier reports to cover the period from 1929 to 1933. This report includes a statement showing the total man-hours per year for maintenance work since 1918, and also the total man-hours for current repairs and a comparison with the average for a test period established, 1915 to 1917, inclusive. It also extends curves of tie renewal, labor, investment and other charges to include the year 1933.

This part of the report was received as information and the subject continued.

Weed Killing—The committee made an intensive study of this subject during the year, but withheld a report in order to incorporate additional material which it considered essential to a complete report.

Gang Organization and Maintenance Methods—In view of the number and complexity of maintenance of way operations, the committee has found it expedient each year to concentrate on certain of the more important operations. During the last year it gave attention to track surfacing, and its present report, therefore, was on this subject. In this report it considered gang organizations comprised of from 52 to 142 men, employing pneumatic tie tamping equipment in crushed stone ballast. The report, detailed and thorough in character, also includes brief consideration of certain general factors associated with any major maintenance operation, including economics, and the operation and retirement of the mechanical equipment used.

The committee stated that while the organizations cited are predicated on the use of pneumatic equipment, electric power units can be substituted readily without materially changing the organization of forces.

As the result of its study, the committee formulated the following conclusions:

(1) That since considerable savings have been realized by many railways through carefully planning expenditures for materials, it is reasonable to expect that still further economies will result from the careful analysis and planning of the use of labor, as expenditures for the latter are greater than for the former.

(2) That the efficacy of any organization of forces for surfacing track requires: (a) that a comprehensive program of the work be prepared in advance, and (b) co-ordination between the agencies purchasing and using materials, in order that materials will arrive as necessary.

(3) That the established schedules should be in such form as to permit readily checking the progress of the work at any time.

(4) That the person responsible for a given surfacing project should, with a perspective of final cost, use every means to determine the most economical method of performing the several operations that make up the whole, and not necessarily employ methods customarily used in performing the same operations individually.

(5) That a supervisor, or other local officer in charge of work, can, with the exercise of judgment as to any necessary adjustments, use the foregoing plans as bases for practical track surfacing gang organizations.

This matter was received as information and the subject was reassigned for further study.

Out-of-Face Renewal of Track—The committee found that the practice of renewing track out-of-face is not practiced to any extent on the American railways. While not overlooking the experience of those American roads which have had some experience in this regard, the committee is, therefore, corresponding with engineers of European roads where such renewal methods are common practice.

The committee reported progress and feels that a complete report can be made next year.

Maintenance of Joints by Welding and Use of Reformed Bars—The committee stated that it had obtained sufficient information to indicate that a very appreciable saving can be realized in track labor by the proper maintenance of joints, either through rail end welding or the use of reformed bars or a combination of the two. It said, however, that enough data had not been collected to warrant a report at this time.

Other Subjects—Without making a report, the committee reported progress in the study of the economies in labor to be effected through increased capital expenditures.

* Assistant Chief Engineer, Missouri Pacific Lines.

Report on Electricity

J. V. B. Duer, Chairman*

As in past years, in fulfilling its assignment to keep the association informed of developments in the application of electricity to railway service, and of the current activities of the Electrical section, A.A.R., the committee presented a brief synopsis of the reports made by the different committees of the section in 1934. The subjects covered in the reports were as follows:

Developments in application to railway service; inductive co-ordination; power supply; electrolysis; co-operation in miscellaneous regulations; overhead transmission line and catenary construction; standardization of apparatus and materials; electric heating and welding; application of motors; clearances for third-rail and overhead working conductors; protection of oil sidings; specifications for track and third-rail bonds; illumination; design of indoor and outdoor substations; high tension cables; application of corrosion-resisting materials to railroad electrical construction; and form of power contract for large blocks of power.

* Electrical Engineer, Pennsylvania.

The committee called attention to the fact that the reports on all of the above subjects appear in Bulletin 369 of the Electrical Section, A.A.R., dated September, 1934.

This report was accepted without discussion.

Report on Water Service, Fire Protection and Sanitation

R. C. Bardwell, Chairman*

The committee presented reports on 9 of its 11 assignments and indicated progress in its study of the other two. It recommended several changes in the Manual and also the addition of material with regard to methods for analyzing the chemicals used in water treatment.

Value of Water Treatment—The efforts of the committee during the year were confined to an attempt to determine the value of water treatment along the following four definite lines:

(1) In the reduction of corrosion of boiler metal and the pitting of boiler flues; (2) in the extension of the boiler washout period; (3) in extending locomotive runs, and more complete locomotive utilization; and (4) in the extension of time for flue renewals granted by government inspectors.

In a short progress report, the committee stated, in part, as follows: A canvass made of the Class I railways shows that on practically all of the railways which have adopted some form of water treatment, the program has resulted in a reduction of from 50 to 70 per cent in the corrosion and pitting formerly experienced. Oftentimes this program of water treatment has been supplemented by the abandonment of a number of poor and corrosive water supplies. It is the opinion of the committee that water softening, especially where a proper alkalinity is used, has a definite value in the elimination of corrosion.

The consensus of opinion of the committee is that water treatment, together with the proper program for blowing of boilers, has decidedly reduced the necessity of washing boilers more frequently than required by Federal regulations. Because of the fact that the water in the boilers does not have the former chance of cooling down, and the further fact that the boilers are not opened and washed frequently, sometimes with cold water, there has resulted a decided extension of the life of fire boxes. This extended life has resulted in gratifying savings to the railways.

Practically all of the railways equipped with water softening facilities have increased locomotive runs from an average of 150 miles to an average of 450 miles. The elimination of engine house expense resulting from this practice shows large savings.

In this same connection, it is now found generally that the locomotive, after completing such long runs, is in condition to be turned in short time, with but little attention necessary to the boilers.

The use of softened water has continued to show the possibility of government extensions of flues beyond the four-year limit. While it is the opinion of some of the railways which operate the extended washout period that this operation of boilers is directly responsible for these extensions, it is the consensus of opinion that the economical extended washout period is not possible without suitable water being supplied to the boilers.

Analysis of Chemicals Used in Water Treatment—In an only partially complete report, the committee set up a method for analyzing sulphate of iron for use in boiler water treatment. This was presented under the three heads; determination of insoluble matter, determination of free acid, and determination of ferrous sulphate. It recommended that the matter submitted be approved for publication in the Manual.

Disinfectants, Fumigants and Cleaning Materials—In its second report on this subject, the committee outlined the many problems of disinfecting and fumigating common on the railways, and not only presented the basic requirements for products suitable for each problem, but also presented a list of the more common products available, with a description of each and methods or directions for their use. It again stressed the difference between deodorants, which have the power only to destroy or neutralize unpleasant odors, and disinfectants and fumigants. It also presented a discussion of cleaning materials, outlining the various needs of the railways for such materials and pointing out the effectiveness of different materials in meeting these needs. Considerable attention was given in the report to the effectiveness and use of hydrocyanic acid gas as a fumigant.

In presenting this part of the report, Chairman Bardwell submitted an addition prepared after the report had been printed, embracing a statement of the precautions that must be taken in the use of hydrocyanic acid as a fumigant, because of its extremely poisonous nature. Dr. Hermann H. von Schrenk, consulting timber engineer, at whose suggestion this additional material had been appended to the report, emphasized the unusual value of hydrocyanic acid as a fumigant, but warned that extreme care must be exercised in its use.

Regulations Pertaining to Railway Sanitation—In a brief progress report, the committee pointed out that the U. S. Public Health Service is of the opinion that the railways in general are complying with their sanitary regulations, with the desired results. Complaints, however, were observed in a paper by the chief sanitary engineer of the Public Health Service, with regard to the handling of oysters and milk on dining cars. The publication of the U. S. Public Health Service dated 1925, covering the permissible limits for mineral constituents of a satisfactory drinking water, was discussed with the Public Health Service, and it was admitted by the Service that the recommendations were not entirely satisfactory. The committee stated that no new regulations pertaining to railway sanitation are contemplated at the present time.

Design and Maintenance of Track Pans—The report on this subject was in the form of a monograph by W. L. Curtiss, mechanical engineer, New York Central, which presented the experience of the New York Central in recent years in attempting to arrive at a standard design of track pan and scoop setting. The monograph detailed the work and the results accomplished by a special committee on the road in 1928, which made a series of water scooping tests at three different track pan locations. The purpose of these tests, it was pointed out, was to determine the proper design of track pan; to determine the correct location of the pan in relation to the top of rail; to determine the correct setting of the water scoop in relation to the top of rail; and to ascertain the most economical speeds at which to scoop water.

Methods of Malaria Control—In a short comprehensive report, the committee reviewed the malaria situation as it prevailed in the South in 1918, and then discussed the measures which have been taken by certain railways and municipalities to overcome the effect of this prevalent infection. It pointed out the large direct loss to the railways through the inefficiency and the hospitalization of labor infected with malaria, and the possibly larger indirect loss to the railways through the lowered output of farms and factories in highly malarial districts, with the attendant lowered purchasing power for goods that would be shipped into these areas.

As a part of its report, the committee suggested an organization and a method of procedure which might well be adopted by a railway in carrying out malaria control work. The organization suggested is built up largely around an engineer trained in malaria control, reporting to the office of the chief operating officer, so that the necessary co-operation can be secured from all departments.

Revision of the Manual—The committee revised and enlarged upon the information on the zeolite treatment of water for locomotives, which appears in the Supplement to the Manual dated July, 1930, and recommended that the revised information be substituted for the earlier material. The revised data points out seven distinct advantages of zeolite treatment, and four considerations considered as disadvantages, at least under some conditions. The committee submitted a revised plan for lugs to be used on standard round hoops, to be substituted for the plan appearing in the Manual, and also presented in revised form the table showing the quantity of reagents required to remove one pound of incrusting or corrosive matter from water. It recommended that the revised table be substituted for that appearing on Page 927 of the 1929 Manual. The new chart presents data on the basis of using hydrated lime instead of common lump lime.

All of the revisions were adopted.

Bibliography—In this report the committee presented a bibliography of material published by recognized authorities on subjects pertaining to fire protection, inspection and insurance.

* Superintendent Water Supply, Chesapeake & Ohio.

Index to Reports on Railway Fire Protection—The committee reviewed the past proceedings of the Association and also the subject-matter in the Manual, and prepared an index to all reports and recommended material pertaining to railway fire protection. The index, which was submitted as its report, contained 363 references, of which 88 have the approval of the Underwriters Laboratories.

Other Subjects—Progress was reported in the study of the cause of and remedy for pitting and corrosion of locomotive boiler flues and sheets, and on types of lime and soda-ash equipment used in water treatment.

Shops and Locomotive Terminals

J. M. Metcalf, Chairman*

Of the six assignments of the committee, three were reported on in detail, with recommendations for a number of important additions to the Manual. Progress was reported in the study of the other subject assignments.

General Reclamation Plants—Following brief remarks with regard to the functions of a reclamation plant, its physical layout and equipment, and its relationship to the scrap plant, the committee presented the following conclusions which it recommended for adoption and inclusion in the Manual:

The reclamation plant should be located at the same point as and adjacent to the scrap plant to insure minimum material handling expenses.

The scrap plant, when the amount of material to be handled warrants, should consist of a crane runway 80 to 100 ft. wide, of sufficient length, having a sufficient number of cranes of 10 to 15 tons capacity, equipped with magnets to handle the materials in the process of classification, etc. Necessary runways should be provided to facilitate the trucking of material to the reclamation area.

The building or buildings should be centrally located with respect to the scrap area; of sufficient length and width to meet individual requirements; and served by a depressed track for loading out the reclaimed materials. They should be constructed of fireproof material, adequately heated, and equipped with electric lights arranged to suit each particular operation.

The building or buildings should be provided with a suitable floor and the runways outside should be paved to facilitate the handling of materials.

There should be adequate provision for the storage of necessary fuel, such as coal, oil, etc.

The plant should be equipped with modern machinery and the appurtenances necessary to insure satisfactory workmanship. These should be selected and arranged to reduce manual work and the movement of material through the shop to a minimum.

These conclusions were accepted without comment for inclusion in the Manual.

In addition to the subject-matter presented in its report, the committee made reference to earlier reports on this general subject, which appear in the proceedings of 1928, 1929, 1930 and 1932 of Division VI—Purchases and Stores, A.A.R. It also submitted a layout drawing of a typical modern reclamation plant.

Car Paint Shops—Continuing its study of this subject, a progress report on which was submitted last year, the committee presented a brief analysis of the 38 replies received to a questionnaire sent out. It also presented a group of conclusions under the two heads, "Freight Car Paint Shops" and "Passenger Car Paint Shops," which it recommended for inclusion in the Manual. The conclusions with regard to freight car paint shops follow:

The paint shop for freight cars may be either of the longitudinal or the transverse type, the longitudinal shop being the more practical in most cases. The longitudinal shop should be open at both ends while the transverse shop should have a transfer table unless it is short enough to be served by a ladder track.

Space should be provided outside the paint shop for the preparing of cars. The most common method of cleaning wood freight cars is scraping, and of steel freight cars is sand blasting. The cleaning space should be so designed that steel cars may be moved into the shop immediately after cleaning and the first coat of paint applied.

The size of the proposed shop may be determined on a percentage basis by the following formula:

$$X = ac/bd$$

X represents the percentage of total cars in service.

a represents the number of cars to be painted annually.

b represents the number of cars in service.

c represents the number of days cars must be in shop.

d represents the number of days the shop is to be operated annually.

This percentage averages about one-fourth of one per cent. The length of time cars are in the shop depends upon the amount of cleaning done inside the shop, the number of coats of paint applied and the amount of stenciling.

The tracks in the shop should be 20 ft. center to center; the distance from the center line of the outer track to the face of the outside wall should be at least 12 ft.; the distance allowed between ends of couplers of cars should be at least 7 ft.; 10 ft. should be allowed between the end of coupler and the face of the wall.

If painting is done by other than the spray process, permanent scaffolding should be provided. These scaffolds should be adjustable and easily operated.

It is preferable to have the paint stored in a separate building, but where this is undesirable, the storage should be in a room separated from the main shop by standard fire walls and approved fire doors.

All electric wiring should be in conduit and all electric switches for lights, fans or other equipment should be located in a separate room away from the paint fumes.

The freight car paint shop should be constructed entirely of fireproof materials, with a concrete floor having a smooth surface and good drainage. The floor may be waterproofed and the corners rounded to facilitate cleaning. All shelving and lockers should be of incombustible material. The shop should be well lighted both naturally and artificially, vapor-proof globes being used. All belting should be eliminated in order that the hazard of static electricity will be minimized.

The shop should be adequately heated and ventilated. Artificial ventilation by fans and blowers, if used, should provide for the circulating of all the air in the shop, consideration being given to the specific gravity of the vapors. Fan blades should be rigid and made of non-sparking material with ample clearance to avoid creating fire by friction, necessary allowance being made for ordinary expansion and loading to prevent contact between moving parts and the duct. Special attention should be paid to the removal of spray paint fumes as fast as they are liberated. This promotes safety, increases the efficiency of the labor and minimizes the danger of possible explosion.

The car paint shop should be provided with an approved automatic sprinkler system and a sufficient number of fire extinguishers, as well as any other fire protection required by local conditions or laws.

In its conclusions with regard to passenger car paint shops, the committee stated that on account of the dust and dirt in the air, especially where cars are being cleaned, passenger cars should be painted in a shop. It stated further that the passenger car paint shop should be separate from the freight car paint shop because of the different classes of work, and because of the possibility of the paint from the spray in spraying freight getting on the adjacent passenger cars. The remainder of the conclusions with regard to passenger car paint shops closely paralleled those with regard to freight car paint shops, with certain additions with regard to cushion cleaning facilities and lacquer applying areas.

L. J. Hughes (C. R. I. & P.) contended that the formula should refer to "capacity" rather than to "size" and suggested that the sentence preceding the formula be changed accordingly. This modification was accepted by the committee.

Because of duplications in the conclusions pertaining to freight car paint shops and passenger car paint shops, it was suggested that portions of these conclusions could be consolidated in order to conserve space in the Manual. The revised report was adopted for inclusion in the Manual, subject to such alterations in form as the committee may make in carrying out this suggestion.

Revision of the Manual—Under this assignment the committee

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presented a new arrangement of the matter now in the Manual under the titles "Engine House Design" and "Ventilation of Engine Houses."

The committee's suggestions were adopted.

Other Subjects—Without making report, the committee reported progress in the study of the following subjects: Welding equipment installations as applied to shops and locomotive terminals; power plants; and car wheel shops.

Report on Track

C. J. Geyer, Chairman*

Following another year of activity, the committee presented detailed reports on 8 of its 11 assignments. It recommended a number of new or revised plans for adoption, and the deletion of considerable material appearing in the Manual.

Revision of the Manual—The committee recommended the withdrawal of a considerable number of plans from the Manual, together with a number of specific additions as substitutions, most of which were referred to in the reports of the various subcommittees. It also recommended the permanent withdrawal of certain definitions of terms withdrawn temporarily at an earlier date: the adoption of a new index to the trackwork plans and specifications; and the revision of several trackwork plans. These recommendations were adopted.

The committee found that the material now in the 1929 Manual, pages 203 to 227, inclusive, with respect to the 10-chord spiral for curve easements, is largely obsolete and is not being used to any extent by the railways. It stated that it will undertake to revise this material and submit a spiral that will meet present practices and requirements. It submitted for adoption revised material relating to the elevation of curves, including tables of equilibrium speeds, comfortable speeds and permissible speeds. Because of objections and suggestions offered from the floor the committee withdrew its recommendation that its revised material relating to the elevation of curves be adopted for inclusion in the Manual, and offered this material as information. It also recommended the withdrawal of the material on Page 229 of the Manual relating to vertical curves, and submitted revised material for adoption, which was accepted.

In a series of other recommendations, the committee recommended the revision of the table on Page 231 with regard to relative speeds through level turnouts, and the withdrawal of the material on Pages 242 and 243 with regard to the resawing and reconditioning of rails for relaying, and the building up of battered rail ends in track. It gave consideration to the diagram in the Manual with regard to the speeds of trains on curves, but recommended no changes in them at the present time. On the other hand, it offered a number of revisions to the material in the Manual with regard to anti-creepers.

The recommendations relating to speeds through level turnouts were withdrawn by the committee, while that concerning the resawing and reconditioning of rails was adopted. Referring to the committee's recommendations concerning anti-creepers L. J. Hughes (C. R. I. & P.) said that it should be made a requirement that anti-creepers be so designed in their manner of gripping the rail as not to result in damage to the rail when equipment becomes derailed. The committee offered to give this matter further consideration; however, its suggestions as to revision of the material in the Manual pertaining to anti-creepers were adopted.

String Lining of Curves by the Chord Method—In its report on this subject, the committee presented a method for string lining curves, using 31-ft. stationing and a 62-ft. chord as a basis. It stated that this particular method was selected because it reflects directly the degree of curve by the ordinates in inches, in both preliminary and completed work. The entire report on this subject, including a detailed discussion of the method and a group of supporting exhibits, was recommended for adoption and inclusion in the Manual and was accepted.

Track Tools—As the result of collaboration with track tool manufacturers during the year, the committee submitted as information plans for rail tongs for use with cranes, for a carpenter's adze, and for stone hooks.

Switches, Frogs, Crossings, Slip Switches, Etc.—The committee, as the result of collaboration with the Standardization committee of the Manganese Track Society, submitted plans for adoption as recommended practice for No. 8 double slip switch with movable center points; No. 10 double slip switches with movable center points; graph showing limitations for the use of crossings with rigid center frogs; No. 7 movable point crossing; details of plates for No. 10 double slip switch with movable center points; details of fittings for double slip switches and movable point crossings; details of rolled rail knuckle rails and movable center points for Nos. 6, 7, 8 and 10 double slip switches and movable point crossings; details of solid manganese steel and manganese railbound knuckle rails for Nos. 6, 7, 8 and 10 double slip switches and movable point crossings; and bill of material for Nos. 8 and 10 double slip switches and No. 7 movable point crossing. In addition, it submitted for adoption a sheet of additional alternates to Plans 101 and 102 with regard to filler blocks for wing rails. These plans are to replace standard plans which the committee recommended be withdrawn. All of the plans were adopted as recommended practice and for inclusion in the Manual.

In addition to the above, the committee offered as information, a plan for frog fillers for rails, 80 lb. per yard and heavier, and a data sheet for standard wheel flanges, treads and gages.

Design of Tie Plates for RE Rail Sections—In view of the failure to secure adoption of the seven tie plate designs which it submitted at the meeting in 1934, the committee gave further study to this subject, and, on October 15, 1934, it put out to letter-ballot a set of four plans for tieplates. These plans, which were included in the committee's report, were for use with 112-lb. RE and 131-lb. RE rails, two designs for each. Briefly, the proposed plates had the following characteristics: Lengths, 11 to 13 in.; one design for each rail with inclined ends, the other with flat ends; the plates with inclined ends having two transverse ribs and those with flat ends having flat bottoms. The following features were common to the entire set: Width 7½ in.; thickness in proportion to the distance from face of outside shoulder to outside end of tie plate; eccentricity ¼ in.; double shoulders; cant, 1 in 40; and rolled crown.

In the punching, four square holes were used at a uniform spacing along base of rail—in the tie plates with inclined ends, four square, and in the tie plates with flat ends, four round "hold-down" holes were used. The "hold-down" holes in the tie plates with inclined ends were so located that one tie boring could be used, and similarly, in the flat end tie plates the "hold-down" holes were so located that another tie boring would serve. Where transverse ribs were used, they were so located that one tie grooving would accommodate them.

The committee reported that the plans failed of adoption.

Reflex Units for Switch Lamps and Targets—The committee reported that three additional roads have started tests of reflex units for switch lamps, and that the two roads which have standardized on these units are rapidly extending their use.

Design and Specifications for Anti-Creepers—As the result of careful study of the subject of anti-creepers, both separately and with representatives of the anti-creeper manufacturers, the committee offered the following eight reasons why it would be impracticable and inadvisable to attempt to prepare a standard design of anti-creeper in competition with the six patented types which now serve the requirements of the railways in both the United States and Canada:

(1) The design of anti-creepers is subject to narrow limits, and we were not able to design such a device that would not conflict with existing patents.

(2) A composite type would be most difficult to design and likewise would involve complex patent aspects.

(3) Four types of anti-creepers comprise about 90 per cent of all such devices produced in the United States and Canada, and six types include approximately 98 per cent of the production for the same area. These are generally different in design, and it may be said that certain of these types best meet requirements in certain grades of service and under certain climatic conditions throughout the country.

(4) Each of the types of anti-creepers is patented and its manufacture and distribution is carefully regulated by the owners.

(5) In the manufacture of anti-creepers, there is little or no duplication of machinery or rolls because of the various designs in use. The reverse is true of tie plates and other similar track devices.

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(6) None of the types of anti-creepers now in use results in the necessity for the railroads to carry a stock of extra parts.

(7) With a device controlled and produced as are anti-creepers, a standard or composite type would remove competition, which would be an economic disadvantage to the railways.

(8) The reduction in the cost of anti-creepers in the last decade has increased in proportion to the cost of steel and labor, which indicates that there is healthy competition and efficient management in this field.

In view of these reasons, it recommended that the subject be discontinued.

Position of Abutting Rails at Fixed and Drawspan Bridges—In a short report, the committee stated that on fixed bridges the same tolerance of rail expansion should be used as in other portions of the track, and that where additional expansion is necessary on long bridges, switch points adjoining stock rails may be used to take up the additional expansion required over and above the general expansion at the joints. As regards the expansion gaps at the ends of draw-bridges, it reported as follows:

The committee recommends tolerance of ½ in. as maximum where the rails abut without an additional wheel riser device, and 2 in. maximum where wheel riser or other effective wheel-carrying device is used. On lines having heavy traffic, the rails should be maintained as close as possible and expansion adjusting devices, either automatic or hand, should be used to maintain uniform minimum expansion. This part of the report was received as information.

Other Subjects—Progress was reported on the following subjects: Track construction in paved streets; corrosion of rails and fastenings in tunnels; and the reclamation of serviceable materials from scrap and retired maintenance of way and structures machines, tools and appliances.

Report on Ties

W. J. Burton, Chairman*

The committee reported on seven of the nine subjects assigned to it. No revisions in the Manual were recommended.

Adherence to Standards—The committee, in groups of 2 to 10 members, made observation during the year of approximately 6,000,000 ties of 10 roads at six wood preserving plants west of the Mississippi river. It reported that an increased number of ties had been purchased in 1934 over recent years, and that, with an adequate supply, the association specifications were being adhered to generally in-so-far as size is concerned. It found a marked improvement in tie inspection by several roads over their practices of a few years ago, although it stated that some roads are still careless in the acceptance of large knots and of decayed small knots. The storage conditions at commercial plants inspected were sanitary in all cases except one, in which case a railroad was responsible for poor drainage conditions.

Referring to the use of anti-splitting and anti-checking irons, the committee stated that while the use of such irons has increased, their application seems to be regarded as a matter of minor importance in some cases, with the result that the full benefit from their use is not being obtained. For example, it pointed out that sometimes their insertion is delayed until splitting has started; some are driven without regard for the most effective placement; some are located so close to the surface of the tie as to induce splitting; and some are hammered first at one of their ends and start into the ties in a diagonal direction instead of parallel to the axis of the tie. It also pointed out that in some sections of the country, with some kinds of wood, the insertion of irons before the tie has undergone any seasoning may be detrimental, resulting in checks which radiate from the irons to the surfaces of the tie. This difficulty, which is encountered only in very green ties, can be overcome by delaying the placing of the irons a couple weeks.

Substitute Ties—As in past years, the report this year consisted of a summarized statement of tests of substitute ties being conducted on a number of roads. In addition to those tests reported on in 1934, the report included the results of the use of a large number of Carnegie steel switch and crossties on the Elgin, Joliet & Eastern and on the Newburgh & South Shore.

Tie Renewal Averages and Costs per Mile—To meet the requests for earlier publication of the renewal statistics, the committee reported that it had again issued a preliminary report on this subject and had presented its tables of renewal averages and costs per maintained mile, derived from reports made to the Interstate Commerce Commission, in Bulletin 366, dated July, 1934 (abstracted in the *Railway Age* of August 18, 1934). The early report was presented in the same form as in previous years, and included data as regards renewals for both the larger roads of Canada and the Class I roads of the United States.

Economics of Ties Longer Than Eight Feet—In a somewhat detailed discussion of this subject, the committee said, in part, as follows:

From theoretical considerations, and considering only the tie as member of the roadway structure, it can be shown that the eight-foot length is too short. For rail having a head 2½ in. wide, theoretical requirements would call for ties nearly 10 ft. long. This length assumes that effective tamping may be had all the way to the ends of the tie, although the Committee on Stresses in Track has shown that this is impossible, so that an even greater length would be desirable for true balance each side of the rail.

With the coming of heavier traffic and of heavier rail, most of the larger roads east of the Mississippi river adopted ties 8½ ft. long in place of those 8 ft. long, and the longer ties are now standard in certain producing areas. Some western roads have also adopted (at least partly) the longer ties. These are being produced together with eight-foot ties in some areas.

Investigations made by the committee over a period of several years disclose that many maintenance of way officers are of the opinion that there are economies in track maintenance which result from the use of ties longer than eight feet and that these justify the adoption of an 8½-ft. or longer tie. This applies particularly to important main tracks.

Following comments on this subject by Dr. A. N. Talbot, favoring the increased length of ties, the committee offered the following conclusions:

It is our opinion that ties longer than eight feet are economically justified in heavy traffic lines and that they may be used to advantage on lighter traffic lines if the cost of the longer tie does not materially exceed the cost of the eight-foot tie. The committee recommends more extensive use of ties longer than eight feet and considers 8½ ft. a desirable length. The general adoption of the 8-ft. 6-in. tie as standard in any tie-producing area will tend to bring the cost of this tie closely to that of the eight-foot tie.

Based on the experience of roads which have made the change, the committee suggests that the uneven tie line which must obtain for a number of years after the change, is not seriously objectionable and that this will not outweigh the advantages of the longer tie. It is also recommended that the ties be centered with the track rather than to attempt to maintain a tie line with the longer ties.

Surplus or Deferred Maintenance of Crosstics—Last year the committee outlined in detail, with tables and examples, a method for determining the approximate average life of ties in track, and also the procedure for making renewal predictions through the use of the tables and method. In its present report, the committee showed how the renewal predictions based on normal life must be adjusted further in order to arrive at the actual number of ties necessary to meet maintenance requirements. Some of the adjustments which it pointed out as essential have to do with the amount and character of traffic; possible reduction of requirements as the result of abandonment of track; possible reduction in the amount of maintenance necessary due to the diversion of traffic; possible necessity for an increase in maintenance; and changes in the track structure which will affect the life of the ties.

In conclusion, the report stated: Having adjusted the renewal prediction for the effect of the above considerations, the resulting figure represents the number of ties that normally will be necessary to meet maintenance requirements. The difference between this figure and the number of ties actually inserted represents, as nearly as may be determined, the amount of either surplus or deferred maintenance with respect to normal requirements.

Pre-Adzing and Pre-Boring of Crossties—The committee presented in the form of a progress report suggested specifications for the pre-adzing and pre-boring of ties. These specifications, although limited in length, cover all of the important phases of

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the work, including, in addition to adzing and boring, the items of grooving, trimming and branding.

Seasoning of Oak Ties—The committee reported that in order to determine the best method of seasoning oak ties grown in southern lowlands, tests of alternate methods of stacking and of the use of protective and coatings are under way at seven treating plants in the Southwest, located on four roads. It expects that the tests will have to run for at least two years before reliable information will be available.

Other Subjects—Collaborating with the Committee on Wood Preservation, the committee also gave consideration during the year to the subject of the best practice in the handling of a tie, from its manufacture to its installation in the track.

This report was received as information.

Report on Maintenance of Way Work Equipment

C. R. Knowles, Chairman*

Continuing its work for another year, the committee gave consideration to 11 subjects and presented detailed reports on 5.

Standardization of Parts and Accessories for Motor Cars—In a progress report, the committee stated that it had given consideration during the year to the design of loose wheel construction for railway motor cars, and had reviewed, with the idea of changing, the material adopted by the Association in 1930 with regard to tight wheels and axles. It also stated that consideration had been given during the year to a number of minor motor car accessories and parts, such as grease cups, shut-off cocks, rail sweeps, and details of ignition systems.

Developments in the Design of Motor Cars—In a comprehensive review, the committee traced the development of the motor car from the early days of the push car, up through the hand-crank and the walking-beam and gear-operated cars, to the modern gasoline engine-operated cars of different sizes and types to meet the requirements of various sizes of gangs and types of work. As regards the more modern cars, it called attention to the many improvements in design and materials which have been made to improve their operating characteristics, adaptability and safety, and the ease with which they can be handled. Some of the improvements mentioned include the simplification in design of parts in both the engine and the car; the use of heat-treated aluminum alloys in car frames and for bearing housings, wheel centers and engine parts; the use of steel alloys and the heat-treatment of certain steel parts to secure equal or greater strength with less volume; the use of special deck and tool tray materials to reduce weight; and the addition of many safety features. It stated that it was impossible to forecast the future trend in motor car design and improvements, but it made reference to the possible development of Diesel engines for power plants and to the progress in metallurgy which it said may be expected to continue, bringing with it still further lightening of motor cars, with equal or greater strength and durability. Summarizing its report, the committee said in conclusion:

(1) All types of motor cars required by present-day methods of maintenance are now available.

(2) Future developments will probably be in refinements in construction rather than in radical changes in design.

(3) In the future, closer co-operation between the maker and user may be expected than has existed in the past.

(4) If future changes in maintenance organization should require cars of a type not now available, this co-operation may be expected to produce the required car quickly. This matter was accepted as information.

Track-Type Tractors in Maintenance Work—Supplementing its thorough reports of the last two years on the use and adaptability of this type of equipment in maintenance work, the committee this year gave primary consideration to the mounting of electric welding generators and cranes on tractors having crawler treads. It pointed out the entire practicability of mounting generators on tractors, and in this regard said that the high degree of mobility of the tractor is a very important feature in keeping the length of welding cable to a minimum, thereby avoiding an excessive drop in voltage and reducing cable maintenance. It also pointed out that the saving in time of moving tractor-mounted welding generators enables the welders to keep their arcs working a greater proportion of the working time, thereby reducing the unit cost of the welding work.

With regard to tractor-mounted cranes, the committee reported, in part, as follows:

Such machines, small enough to be handled easily, gasoline or Diesel motored, mounted on crawler treads, having a full-circle swing and with boom lengths necessary to handle the standard lengths of rail, are available. By changing the attachments, the machine can be converted into a dragline, pile driver, clamshell or shovel, and can be used for handling any class of material or for any ditching required in maintenance of way work.

As a part of its report, it included a list of suggested uses for tractor-mounted cranes equipped with the various attachments available, and also a tabulation of the more important characteristics and dimensions of the light-weight and heavy-weight machines available. All the matter under this heading was accepted as information.

Use of Ballast Discers—Under this assignment, the committee presented a comprehensive discussion of the various machines and attachments for the mechanical working of the ballast in the track shoulders to improve drainage, kill weeds and to reshape the ballast section. It reported extensive use of this class of equipment and highly satisfactory results where the equipment used is suited to the particular conditions at hand. Following are the conclusions arrived at by the committee, which were submitted with the recommendation that the subject be discontinued:

(1) Ballast discers of both the large and small types are used extensively in the treatment of ballast shoulders.

(2) The smaller machines are particularly adapted for use in dirt, cinder and gravel ballast, and for cutting sod lines and light weeding.

(3) The large machines operate both discs and scarifiers for cleaning ballast and removing mud pockets. The operation of the larger machines with discs is also more satisfactory than the smaller machines in rock and slag ballast, or in gravel ballast where large stones make it difficult to keep the discs down.

Track Welding Equipment—The report on this subject was divided into three distinct parts. In the first, the committee, recognizing that certain electrical characteristics are desirable in generators used for electric welding, presented a partial list of these characteristics, together with a description of each. The characteristics discussed are as follows: Open circuit voltage, suitable volt-ampere characteristics, constant voltage generators, inherently regulated or variable voltage generators, minimum tendency of electrode to stick to work, quick current recovery, minimum fluctuation in welding current, adjustment of welding current, adjustment of current for varying lengths of cables, wide range of current adjustment, high efficiency, ample capacity, weight and durability, and characteristics of auxiliary generators.

In addition, in this section of its report, the committee discussed the characteristics of the gasoline engine prime movers used with electric arc welding equipment, and presented a method for determining the proper size of engine to be used.

As the second part of its report, the committee presented the detailed information which one railway supplies to its welders so that they may familiarize themselves with the terms used in connection with electric welding equipment and the operation and maintenance of this equipment. This information included a definition or explanation of terms used in connection with alternating current, electrical machinery, direct current generators, and welding operations themselves. The information presented also included instructions for operating a welding generator and for setting up open circuit voltage.

As the third section of its report, the committee presented monographs by C. H. R. Howe, cost engineer, Chesapeake & Ohio, and William Elmer, special engineer, Pennsylvania, on a new precision batter progress gage and two rail-end batter curve tracing machines. All this material was accepted as information.

Other Subjects—The committee reported progress in the study of the following subjects: Revision of the Manual; machines used for rail laying, and their auxiliary equipment; and the preparation of a manual of instructions for the care and operation of maintenance of way work equipment. It recommended that the two other subjects—methods of keeping data on work equipment and labor saving devices, and the selection and training of maintainers and operators of work equipment, on which it made no report, be discontinued for the present.

* Superintendent Water Service, Illinois Central System.

Iron & Steel Structures

G. A. Haggander, Chairman*

The outstanding feature of the report of the Committee on Iron and Steel Structures was the new Specifications for Steel Railway Bridges. These specifications were submitted for study and criticism at the convention in 1934, and after being revised on the basis of the comments received, were submitted this year under the heading "Revision of the Manual" for adoption as a substitute for the specifications now in the Manual (adopted in 1920).

These specifications were offered also as the committee's report on four other assignments, namely, on Tests of Steel Columns and Formulas for Design, the Use of Alloy Steels for Structural Purposes, Impact Railways Bridges, and the Bearing Value of Small Rollers, the results of studies made by the committee on these subjects being incorporated in the specifications. In addition, they were discussed in monographs prepared by members of the committee along with several others that were offered as material to support various provisions of the specifications. These monographs are listed below:

The Change in Grade of Structural Steel, by A. W. Carpenter, engineer of bridges, New York Central Lines

Comments on Column Formulas, by F. E. Turneaure, dean of the College of Engineering, University of Wisconsin

Elastic Stability of Plates Subject to Compression and Shear, by Otis E. Hovey, assistant chief engineer (retired), American Bridge Company.

Shear in Column Bracing, by Shortridge Hardesty, consulting engineer, New York

Live Loads on Multiple Track Bridges, by H. C. Tammen, consulting engineer, Kansas City, Mo.

Live Loads and Unit Stresses in Design, by Mr. Hardesty

Impact in Steel Railway Bridges, by J. B. Hunley, engineer bridges and structures, C. C. C. & St. L.

Net Section of Riveted Tension Members, by C. H. Chapin, designing engineer, C. & O.

Bearing Value of Small Rollers, by Wilbur M. Wilson, research professor of structural engineer, University of Illinois, who conducted a research project on this problem for the committee.

The specifications for steel railway bridges aroused more than two hours active discussion. Theodore Doll (A. T. & S. F.) inquired whether it was the intention of the committee to remove the specific limit as to minimum depth of spans which had been a feature of former specifications. Chairman Haggander explained that owing to the provision for the use of alloy steels, which generally produce greater deflections (owing to the use of higher stresses) than carbon steel in the structures in which they are employed, the limiting deflection cannot be expressed by any rational formula, and the committee believed that by specifying depth ratios the question of maximum deflection could safely be left to the judgment of the designing engineer. L. W. Skov (C. B. & Q.) added that if the provisions of the specifications are followed in other respects, no trouble will be experienced with deflections greater than those that would have been obtained under previous specifications. A motion to insert a provision that the deflection be limited to the amount suitable to the type of structure was lost.

C. H. Sandberg (A. T. & S. F.) criticized the provision that at the end of skew bridges the ends of the supports for each track shall be square with the line of the track. After a long discussion, in which inquiry, answered in the affirmative by the chairman, was made whether this provision was intended to apply to both open and ballast decks, various motions to amend this requirement were lost.

M. Hirschthal (D. & L. W.) brought up the question of the proper loading for railway bridges, calling attention to the fact that tender loadings have changed materially since the Cooper system of loading was devised, and that the E-72 loading proposed in the specifications will require a loading of 288,000 lb. in a length of 40 ft. He also suggested segregating impact allowances for different lengths of spans. Chairman Haggander replied that a thorough investigation of the various systems of uniform loadings disclosed that the Cooper loadings come nearer representing the actual loadings imposed by present day equipment than any other in use, although the locomotive upon which it is based is not a modern locomotive.

In response to a criticism of the wording covering the loading allowances for multiple-track spans, the committee agreed to clarify the language of these requirements.

In response to a question relative to the speed of the locomotive upon which the impact formulae are based, Chairman Haggander replied that these formulae were based on a maximum of seven revolutions of the driving wheels per second and that the engine speed will vary with the diameter of the drivers. Mr. Doll stated that public authorities who are required by law to participate in the cost of railway structures built for locomotive loadings are beginning to question the reasonableness of the impact allowances in the A. R. E. A. specifications, and that the Santa Fe has been able to meet these criticisms by developing an impact formula which takes into account variations in speed of the locomotive. He predicted that the impact values computed by the formula developed by the committee will exceed the values found during the investigation, upon which the formulae are based and insisted that any rational formula should include factors for speed and span length.

Mr. Haggander replied that speed was not considered as a factor of importance in design loading, since in the development of the formulae the maximum speeds were used that would give the highest impact value. He then called on Mr. Hunley, who made these investigations and who explained that these impact formulae do take into account the speed which produces the maximum impact. He explained at great length the methods used in arriving at the critical speeds for various lengths of spans and the manner in which the speed is incorporated in the formula.

A. C. Irwin (Portland Cement Association) asked whether the formula for short spans does not give a result higher than actually occurs. Mr. Hunley replied that, if anything, the formula may give lower results than are actually imposed, including the low-joint effect which, while it may not be true impact, does add to the live load. On short spans the low-joint effect may be very large, while on long spans normally it is relatively small. No definite information is available as to the effect of low joints, segregated entirely from other factors, and Mr. Hunley said that the only way in which this can be determined is to make a test with electric locomotives which are not counterbalanced.

In view of the fact that the committee was unable to publish the complete report of the investigation of stresses in steel spans conducted by Mr. Hunley, B. R. Leffer (N.Y.C.) gave results of his investigation on the correctness of the formula as presented by the committee. By reason of his original skepticism of the correctness of the deductions he obtained data on four independent investigations, including that made by the A.R.E.A. in 1911, recent British investigations and those made in India recently. He found that all of these investigations agreed within very narrow limits with Mr. Hunley's report. The chairman then called on O. E. Selby (C.C.C. & St.L.) who explained that while the effect of the hammer blow of the counterbalance is not delivered at a point six feet above the rail on a curve, it is applied in such a way that it has the same effect as if applied at a point six feet above the rail, and thus added materially to the live load.

Mr. Doll also criticized the basic working stresses advanced by the committee on the ground that the quality of the steel has been improved greatly in recent years and considerably in excess of that in use when the lower working stresses of the former specifications were adopted, yet the new working stresses presented in the present report have not been raised proportionately. Mr. Haggander replied that the yield point of the new steels has been increased by about 3,000 lb., and this increase should be considered in the specifications for working processes; that the working stresses have been increased but that there was some difference of opinion in the committee as to whether the increase should be made proportional to the increase in the value of the yield point.

At the conclusion of the discussion, the specifications were approved for inclusion in the Manual.

Other features of the report are reviewed briefly below:

Revision of the Manual. In addition to the new specifications, the committee offered a revised paragraph covering the design of the flanges of segment girders of rolling-lift bridges as a

* Bridge Engineer, Chicago, Burlington & Quincy.

substitution for the corresponding paragraph in the Specifications for Movable Railroad Bridges now in the Manual. This revision was based on observations of the behavior of bridges in service and on research conducted on large rollers at the University of Illinois.

Methods of Strengthening Existing Bridges. This comprised a statement of principle and rules of good practice in the conduct of this important phase of the bridge engineer's duties and was submitted for adoption and inclusion in the Manual. In the main, these comprised detailed suggestions concerning tthe manner in which the various details of girders, trusses and floor systems may be strengthened with precautions to be observed in the conduct of the work. The report also makes the pertinent observation that, "in general, the strengthening of a span under traffic is undertaken only to increase the strength of certain weak parts rather than to strengthen the span as a whole." While repeated reference is made to measures for reinforcing to which welding is applicable, the report concludes with the following general comment on welding: "The method is still in the early stage of development, but it has great possibilities, and as the art is improved its use can be extended. For the present it would be well to confine it to details and points where failure of the weld will not result in complete failure of the structure."

These principles were approved for inclusion in the Manual.

Other Subjects:—The committee reported progress on the following subjects: Specifications for fusion welding and gas cutting for steel structures; design of rivet heads for steel structures; stresses in wire ropes bent over sheaves; bronzes for various uses; expansion joints; the design of tension members and connections in which rivets develop tension; and the effect of proposed increases in vehicle weights on highway bridges.

Report on Rail

Earl Stimson, Chairman*

The committee presented detailed reports on seven assignments relating to rail and allied subjects, and, in addition to recommending several revisions in material in the Manual, recommended for adoption a design of rail joint bar for use with 131-lb. R.E. rail.

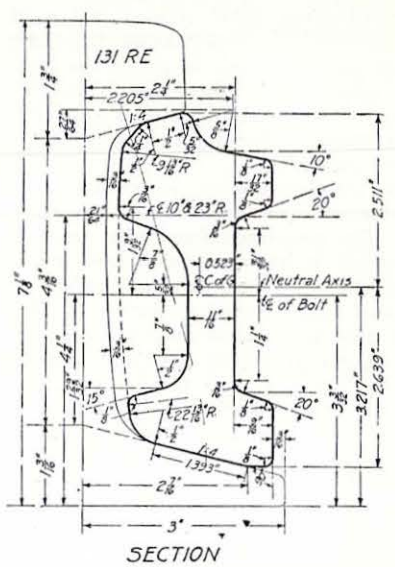
Rail Mill Practice and Manufacture—The committee reported that considerable progress had been made in the Joint Investigation being carried on at the University of Illinois by the Rail committee and the Rail Manufacturers' Technical committee to determine the cause of and remedy for transverse fissures and other rail failures. During the year, field investigations and tests of dynamic wheel loads were made on both the Baltimore & Ohio and the Pennsylvania, and several new tests were undertaken in the laboratory. Among the latter were tests of rail, using the bend test in comparison with the drop test, and a series of tests of rails made by various controlled cooling processes, to determine the effect of these processes in minimizing shatter cracks in steel. The committee also reported that a series of tests of rail steels produced under controlled low temperature conditions, is in progress at Wright Field, Dayton, Ohio, through the courtesy of the United States Army Air Corps.

A.A.R. Rail Fissure Detector Car—In a brief report, W. C. Barnes, engineer of tests for the committee, described the new trailer car housing provided during the year for the A.A.R. detector equipment, and also the new specially-designed and powered tow car provided to haul the detector equipment.

Mr. Barnes cited the advantages of the new cars, especially in relieving lessee roads from furnishing and maintaining their own tow car equipment, and pointed out that because of the increase in the service provided, the rental charge had been increased from a flat rate of $85 a day to $100 a day. No operating statistics were given for the last year, but in presenting this report, Mr. Barnes stated that during the six years the detector car has been in service it has tested more than 38,000 miles of track.

Rail Failure Statistics for 1933—This report, as in the past, contained data presented by W. C. Barnes with respect to rail failures. The statistics presented, which were brought up to date as of December 31, 1933, were compiled, as formerly, in accordance with the standard method of basing the failure rate on mile-years of service in track. Statistics on the 1928 rollings of all mills show that for the five-year period (1929-33), there were 76.4 failures per 100 track miles, a decrease of 36 failures below those reported in 1934 for the 1927 rollings. The failure rate for the 1928 rollings is the lowest that has been recorded since these rail failure statistics have been presented, with the single exception of the rate of 74.0 reported for the 1914 rollings. As in past years also, the report contained an analysis of rail failures, with respect to the rollings of the different mills, and a number of tables, diagrams and charts showing trends in failure rates. In former reports, the mill comparison table presented one average rate of failure (service plus detected) for the five years' rollings for each mill. Now that the use of detection methods is resulting in detection and removal from track of large numbers of failed or defective rails before actual breakage can occur, it has been thought advisable to present rail failures separately for service and for detected failures.

Transverse Fissure Statistics—The report on this subject, prepared by W. C. Barnes, was again a review of the transverse fissure situation, brought up to date and presented largely in tabular and chart form. Some of the more important data submitted included transverse fissure failure records of individual roads over a period of years, and fissure failure rates by mills. The accumulated grand total of fissure failures, service and detected, reported to December 31, 1933, from all rollings, was 74,405; or an addition during the year of 9,124. This is 2,070 more than were reported in 1932, brought about by a decrease of 166 service failures and an increase of 2,231 detected failures.



Physical Properties		One Bar	Two Bars
Moment of Inertia	In.⁴	16.1	32.2
Section Modulus	Above N.A. In.³	6.4	12.9
	Below N.A. In.³	6.1	12.2
Area	Sq. In.	6.49	12.97
Net Weight, 24" Long, Lbs.		43.3	86.5
Net Weight, 36" Long, Lbs.		64.9	129.8

Joint Bar for 131-Lb. RE Rail Recommended for Adoption

The curves showing the total fissure failures reported each year are of particular interest this year as they show that in 1933, for the first time, more fissured rails were detected (4,661) than were reported as broken under service (4,463). An interesting fact disclosed by the table which shows all transverse fissure failures, service and detected, accumulated from the year rolled to December 31, 1933, for each year's rollings from each mill is the wide variation in the total failures in the different years rollings of several of the mills.

Rail Lengths in Excess of 39 Ft.—In a brief progress report, the committee advised that it had found the subject of increased rail lengths over 39 ft. to be extremely complex. After pointing out the more important considerations involved from both the standpoint of the railways and the rail manufacturers, it stated that it is making a determined effort to secure extensive

* Chief Engineer Maintenance, Baltimore & Ohio.

detailed information on this subject both in this country and abroad.

Design of Joint Bars—After further study during the year of a design of joint bar for 131-lb. R. E. rail, the committee submitted a design of bar for this section, which it recommended for adoption and publication in the Manual, and which was adopted without discussion.

The committee stated that in the design of the bar it had been guided largely by the results of the work of the Committee on Stresses in Railroad Track, which indicated the symmetrical type of joint bar as best meeting the requirements of a rail-joint bar. After pointing out the advantages of its design, which is of the same general types as the 112-lb. joint bar section adopted by the association last year, the committee said that both the Eastern and Western railroad associations have rendered opinions that the new bar does not infringe any known patents.

Method for Conducting Service Tests of Joint Bars—In a preliminary report, designated "Special" because the subject originated with the committee and has not been officially assigned to it, the committee proposed an outline for conducting service tests of various types of joint bars. This outline, which the committee desires to use in connection with certain tests which it is about to undertake, includes a list of the joints to be tested, the names of the roads on which it is recommended that the test be made, and numerous details with regard to the conditions to surround the tests and the records to be compiled.

Revision of the Manual—Under this assignment the committee made two important recommendations. The first had to do with revision of Form 402-C, Annual Report of Rail Failures and in the instructions accompanying this form. The major change in this form was made to permit the separation of transverse fissure failures from other types of failures, and the separation of failures detected by detector cars from those found occurring in service. These revisions were approved for inclusion in the Manual.

The second recommendation proposed the revision of the Manual specifications for quenched carbon-steel and alloy-steel track bolts. The committee found that less than half of the roads represented in its membership were using the A.R.E.A. specifications, and that almost an equal number were using specifications adopted by the American Society for Testing Materials. Feeling that this was undesirable, the committee revised the association's specifications with the hope that they will be approved by the A.S.T.M. and adopted generally by all roads. This statement was accepted as information.

It reported progress in the revision of Form 402-A, Foreman's Report of Rail Failure.

Economic Value of Different Sizes of Rail—The committee listed the various factors involved in determining the economical value of different sizes of rail, and then presented an analytical discussion of the problem, showing first how to determine the minimum weight of rail to meet stress requirements, and then how to compute the effective track resistance for different sections of rail and different track supports. It pointed out, as a result of its analysis, that both the stiffness of the rail itself, as indicated by its moment of inertia, and the stiffness of the combined rail and track structure, as indicated by the effective track resistance, are of value in preventing and resisting the irregularities in track. The committee, however, was not able to put a money value on rail stiffness, so requested that the subject be continued for further study.

L. J. Hughes (C. R. I. & P.) suggested that it would be helpful if the committee would express both the moment of inertia of the various weights of rail and track resistance in relative values, and that the combination of these values should be studied. He had found that when the relative value of either is taken alone it does not give a correct value for the economic design of track, since the two do not increase at the same rate. He believed that the effect of an increase in the stiffness of the rail has been given too high a value because the lower corresponding values of track resistance introduce a factor that has not been properly taken into account.

For this reason, it was his belief that there has been too much of a trend toward the use of heavy rail without proper consideration of other factors. "Track resistance," he said, "is the most important thing to secure and this can be obtained by other means, such as heavy tie plates, better joint fastenings, etc., rather than by stiffer rail alone."

W. C. Barrett (L. V.) said that it had been the experience of the Lehigh Valley that stiff rail was the most important factor in securing economical track construction, although the other factors mentioned are not to be ignored. Without an increase in the stiffness of the rail, however, the other improvements are of little avail.

Dr. A. N. Talbot (U. of Ill.) expressed surprise that the studies of the economic value of different sizes of rail, as presented in the report, had been based on the effect of a single wheel load instead of a group of wheels. The studies of the Special Committee on Stresses in Track had shown that there must be relation between the stiffness of rail and the loading as applied by a group of wheels. He expressed the hope that the committee would follow this matter up as the formula given in the report is misleading, since it is based on a single wheel load.

He also said that stiff rail does have a definite effect on track resistance, but that full advantage cannot be taken of it unless it has proper support. Therefore, to obtain the maximum economic value of any weight of rail, ballast, ties, rail joints and other items of construction must be to a corresponding standard, for which reason they should be considered in any study of the economic value of different rail sections.

J. B. Kelly (M. St. P. & S. Ste. M.) suggested that the effect of counterbalance be given more consideration than it has heretofore received, and that this committee should take it into account in making its economic studies on rail. He also suggested the advisability of an appropriation by the A.A.R. to enable the association to determine the effect of counterbalance on rail. J. C. Irwin (B. & A.) seconded this suggestion, stating that expenditures to obtain definite information on this somewhat obscure point would be well worth while. F. M. Patterson offered the suggestion that any such investigation be extended to include the effect of electric as well as steam locomotives.

J. M. Farrin (I. C.), chairman of the subcommittee presenting the report, called attention to the fact that the subject under study is primarily that of determining how much money will be saved by increasing the weight of rail. From his studies, he believed that the railways should study both the reduction in maintenance that has been effected by the installation of heavier rail and the effect of traffic on maintenance expenses as a check on the theoretical study that the committee is making.

Other Subjects—Progress was reported by the committee in its study of the following subjects: Cause and prevention of rail battering and methods of reconditioning rail ends, fastenings and frogs in track; redesign rail sections; cause of corrugation of rails; specifications for the classification of rail released from track; and consider the design of joint bars of the angle bar type.

H. F. Moore Speaks

Following the presentation of the committee's report, Professor H. F. Moore, University of Illinois, gave an informal progress report, which was illustrated with lantern slides, on the current status of the Joint Rail Investigation. This work, he said, is being carried on under four main heads, (1) a laboratory investigation of the mechanism of the development of transverse fissures; (2) laboratory tests of failed rails; (3) investigation of manufacturing processes; and (4) field tests of rail in service.

So far, the laboratory has been unable to develop transverse fissures through flexure alone, although their development can be accelerated by repeated flexure. It is only by the repeated application of rolling loads that transverse fissures have been developed in the laboratory, and this can be done when the bending stress in the rail is zero, but so far it has been accomplished only in rails in which shatter cracks are present. From the results so far obtained, although no conclusions can be drawn, it is assumed that shatter cracks may be an important factor in the production of transverse fissures. He called attention to the fact, however, that many rails containing shatter cracks are giving satisfactory service and may continue to do so until the rail is worn out, since it seems impossible to produce transverse fissures with wheel loads less than 40,000 lb.

He discussed at some length the various tests applied in the acceptance of rails purchased and said that the ordinary drop test is not entirely satisfactory because it does not disclose the presence of shatter cracks, nor does it represent conditions that a rail must meet in service. He suggested the possibility of replacing this with a bending test.

He then discussed the various thermal treatments that are being given rail and the hypotheses of the formation of shatter

cracks and showed how these hypotheses fitted in with the present knowledge of the effect of thermal treatment in reducing the formation of shatter cracks. In this connection he showed a number of charts in which the characteristics of thermally treated rail, including Brinnel hardness, ductility, etc., were compared with those made in the ordinary way. He also showed by the results of numerous experiments the effect of low temperatures, from -40 deg to -53 deg., on rail steel, in which the tensile strength is increased somewhat but the ductility is noticeably lowered.

Future work is to include further investigation of the effect of thermal treatment, field tests on an increasing tonnage of rail in service, methods of detecting the presence of shatter cracks, and a correlation of wear and batter on both ordinary rails and rails that have been given thermal treatment.

Signals and Interlocking

P. M. Gault, Chairman*

The report of the committee was presented under the two main heads—Developments in Railway Signaling, and Principal Current Activities of the Signal Section, A. A. R.

Developments in Railway Signaling—Under this head the committee first discussed automatic train control and cab signals. It pointed out that since the 1934 meeting, the Interstate Commerce Commission has granted the petition of the Chicago, Milwaukee, St. Paul & Pacific to discontinue the maintenance and operation of the automatic stop feature of its train control installations, retaining in service automatic cab-signal devices, and has denied the petition of the Pittsburgh & Lake Erie for authority to discontinue its automatic train-stop installation. A brief statement of the facts in both cases was presented, together with the Commission's reasons for denying the petition of the P. & L. E.

The committee continued its studies of interchangeability and stated that it either has issued or will issue shortly reports on four installations where interchangeability is involved. It also, co-operating with the Bureau of Safety, continued to make investigations of unusual cases of improper operation of train-control devices. It made specific reference to a recent instance of improper operation due to magnetized engine truck wheels.

The committee reported that the proposed standard aspects and indications for continuous automatic cab-signals, shown on Page 342 of the Signal Section, A. R. A. 1934 annual meeting advance notice, and which were submitted to letter ballot, have been approved by the Signal Section for inclusion in the Manual. Summarizing the situation as regards automatic train control, automatic cab-signals, and equipped locomotives as of September 1, 1934, the committee stated that there were in service in the United States and Canada a total of 8,572.7 road miles and 15,889.4 track miles of automatic train control. As of the same date, there were 1,890.7 road miles and 4,344.9 track miles equipped for automatic cab-signal operation, and a total of 9,225 engines equipped with various methods of train control. It stated that a total of 1,895 track miles of automatic train control has been discontinued to date by authority of the I. C. C., involving a reduction of 640 locomotives and 10 motor cars from the total equipped originally.

In the remainder of its report, the committee defined and discussed briefly the functions and advantages of automatic interlocking, dual-control selectors for switches, facing point locks for spring switches, remote control, centralized traffic control, and car retarders. It said that as of January 1, 1934, there were 504 remote control points in service on 65 railways, controlling 654 single switches, 275 crossover switches and 43 derails, with 1,000 remote-controlled semaphore signals and 1,953 remote-controlled light signals. As of the same date, car retarders were in service in 37 yards on 21 railways, involving 1,125 classification tracks, 1,020 retarders, 1,147 switches, 565 skate machines, and 92 control stations. As of July 1, 1934, there were 141 installations of centralized traffic control (C. T. C.) on 41 railways, involving 1,676.6 miles of track and controlling 969 switches, 781 semaphore signals, 2,388 light signals and 166 passing sidings with 779 "OS"ing points.

* Signal Engineer, Missouri Pacific.

Current Activities of the Signal Section, A. A. R.—This report includes a statement of the investigations which the Signal Section made from November, 1933, to November, 1934. It lists the specifications, drawings and requisites which have been revised; the miscellaneous revisions recommended, and the new specifications, drawings, conclusions, standards, tables, instructions and definitions which have been prepared; and, in addition, the forms and drawings to be removed from the Manual.

The report was received as information.

Report on Complete Roadway and Track Structure

J. V. Neubert, Chairman*

The committee, a new special committee, presented a brief report on complete roadway and track for various loads and traffic densities. It said in part as follows:

This assignment contemplates the assembling of the data which have been developed by the several fundamental committees of the association, and the proper grouping of the data to form complete track structures to meet the requirements of various loadings and traffic densities.

We have felt that the first thing to do is to decide upon the rail sections to build the study around, and the proposed suggestion is to use the three basic sections adopted by the A.R.E.A., namely, the 90-lb. R.E. section, the 112-lb. R.E. section, and the 131-lb. R.E. section. It is felt that these sections meet general traffic requirements, and, therefore, for each of these sections we shall develop several classes of track. For example, under the 90-lb. rail study, certain traffic densities or speeds will require stone ballast of a certain depth; crossties of a certain size, class and number per rail, with or without tie plates; signals; interlockers; train control; etc. Other traffic densities will justify this rail section, but gravel, cinders or other ballast of a less expensive character will meet the requirements; automatic signals and train control will not be required; etc. This same study will also be grouped around rail sections of 112 lb. and 131 lb., in the same manner to meet the different loading and traffic conditions.

In answer to a question from A. N. Reece as to whether it would be desirable for the committee to consider the value of a rail section heavier than 131-lb., Chairman Neubert replied that under the instructions given it, the committee had no alternative but to accept the recommendations of the various technical committees and in this case it was bound by the opinion of the Committee on Rail.

Report on Stresses in Track

Dr. A. N. Talbot, Chairman†

The committee reported that one of its major activities during the year had been the study of the design of the joint bar for rail joints and the effect of changes in section upon its properties and upon its value as a part of the joint, together with an examination of certain patent claims on bars, their possible limitation on design, and the purpose of the bars as expressed in the claims.

It stated that various instruments have been designed and built to facilitate the measurement of the profiles, shapes and straightness of joint bars and rail, and their position with respect to each other in the joint. It also stated that inspection tests had been made of rail joints in track on several roads for the purpose of learning the sources of the wear of the joint bars and the rail, the places of wear, information bearing on the mutual interaction of worn bars and rail when under load and when the bolts are newly tightened, and other information relating to the stability and maintenance of rail joints. It indicated that much progress had been made, but that much additional data must be collected before an analysis of the findings can be made.

The committee co-operated with the Committee on Locomotive

* Chief Engineer Maintenance of Way, New York Central.

† Professor Emeritus, University of Illinois.

Construction of the Mechanical division in a further effort to show the need for a comprehensive investigation of locomotive counterbalancing and other vertical and lateral forces of the wheels of locomotives and cars on the track, as well as the resulting reactions of track of different grades and their effect upon the rolling stock. A report on the results of this co-operation with the Committee on Locomotive Construction was prepared and is being held in abeyance by the committee awaiting a more favorable opportunity for its presentation.

In this same connection, the committee reported that further study had been made of the subject of counterbalancing and of the opportunities for better counterbalancing the main driving wheels of existing locomotives, as well as of the recommendations of the Mechanical division on this general subject.

The report was presented by Dr. Talbot and was received without comment.

Rules and Organization

E. H. Barnhart, Chairman*

Collaborating with appropriate committees within and outside the association, the committee developed a large number of additional rules for the guidance of employees in the maintenance of way department.

Maintenance of Telegraph and Telephone Lines—In collaboration with the Telegraph and Telephone section of the A. A. R., the committee prepared a total of 42 rules for the guidance of employees charged with the maintenance of telegraph and telephone lines and appurtenances. These rules, which space will not permit reprinting here, were submitted as complete with the recommendation that they be approved for publication in the Manual, and they were so accepted.

Maintenance of Terminal Structures—Under this assignment, which excludes consideration of buildings, the committee, with the approval of the committees on Yards and Terminals and on Shops and Locomotive Terminals, presented the two following rules with regard to oil houses:

Rule 1252—Adequate ventilation must be maintained in structures where inflammable liquids are stored.

Rule 1253—In case of leaks or the collapse of inflammable liquid storage tanks, the contents must not be permitted to drain into the sewers, and must be confined, so as to keep the liquid from open fires.

These rules were accepted as information.

Protection of Treated Ties and Timber—Collaborating with the Committees on Ties, Wooden Bridges and Trestles, and Wood Preservation, the committee, in a progress report, presented three rules concerning the protection of treated timber; seven rules concerning the protection of treated piling; four rules concerning the handling and storage of treated ties, with an addition to Rule 696 in the Manual, with regard to the manner of stacking ties treated with zinc chloride; and nine rules concerning the protection of treated ties in connection with making renewals, with an addition to the second sentence of Rule 703 in the Manual, with regard to avoiding puncturing treated ties with a pick, adze or other sharp tool when making tie inspections for renewals. In addition, the committee proposed three rules for the protection of treated switch ties and two rules for the protection of treated timber and trunking.

Rules for Fire Protection—Under this assignment, collaborating with the Committee on Water Service, Fire Protection and Sanitation, and with the Railway Fire Protection Association, the committee prepared and submitted four rules governing, respectively, the duties of watchmen, bridge and building foremen, painter foremen, and water service repairmen or gang foremen, which were accepted as information.

Revision of the Manual—The committee recommended changes in Rules 338, 389, 399 and 410 appearing in the Manual and having to do, respectively, with the duties of section foremen, bridge and building foremen, mason foremen and painter foremen. It also recommended a change in Rule 1017 having to do with the painting of buildings, and in Rule 1283 with regard to the inspection and maintenance of turntables. In addition to these revisions in rules and the changing of the numbers of a number of other rules, the committee submitted for substitution in the Manual, revised organization charts for the maintenance of way department, under both the departmental and divisional systems.

All of these recommendations were adopted except the organization charts for the maintenance of way department, which, on a motion from the floor, were deleted from the Manual.

* Asst. Div. Engr., Baltimore & Ohio.

Economics of Bridges and Trestles

Arthur Ridgway, Chairman*

The committee, a special committee, made what might be termed a preliminary report on the comparative economic value of steel, treated timber and concrete in bridges, trestles and viaducts under various conditions of service, giving due consideration to the relative influence of durability of materials and obsolescence of property. Abstracts from the report follow:

It is commonly recognized that owing to the widely different physical characteristics of the three kinds of engineering materials—steel, treated timber, and concrete—they are not equally adequate for all purposes, but are specially adaptable to particular purposes. That which costs least may be extravagant, and the purchase of a high-priced article may be a provident transaction. It all depends on intrinsic value of that for which a price is paid or cost incurred. Economics is, therefore, a weighing of values, that is, a comparison of value received with the price paid. The value received is not necessarily physical property, but may be and often is a need or a use. The matter of economics may be expressed mathematically thus:

Economy = (Value) — (Price).

From this it is clear that when intrinsic value, be it use, need, physical property, or whatnot, equals or exceeds the price paid, the exchange is economical. Conversely, if the price paid is more than the intrinsic value, economy is negative and the transaction is extravagant.

In the case of a bridge or other physical property not to be consumed, stored, or immediately used up, its value is to be found largely in its utility, and since its price is not a spot cash transaction but involves other expense, the economy equation may be written:

Economy = (Utility) — (Cost),

in which utility is the aggregate of several independent values, and cost is the sum of several amounts of money.

The economics of bridges and trestles vitally involves the time element, and to be of value, comparative economy must be computed for a fixed period of time, say a year. The complete annual economy formula or equation applicable is

$$E = (U + S + A) - \left(Cr + \frac{C'r'}{(1 + r')^n - 1} + M + F + T\right)$$

This formula will give the amount of annual economy "E" obtained in any type of structure by substituting proper numerical quantities for the symbols according to the following descriptions:

U = The utility value of carrying the annual volume of traffic.

S = The security or reliability per annum of uninterrupted or tardy service.

A = Appearance or esthetic value.

C = Cost of original construction, including the cost of removal and a credit of salvage value of the existing structure.

C' = Cost of replacement at the end of serviceable life, including the cost of removal and a credit of salvage value of structure replaced.

r = Prevailing annual rate of interest on borrowed money.

r' = Annual rate of interest that can be obtained on sinking funds.

n = Serviceable life in years.

M = Annual cost of maintenance.

F = Annual cost of fire insurance.

T = Annual cost of taxes.

Recognizing that some of the most important factors required in the equasion are apparently intangible, the committee stated that it is undertaking to collect and interpret the results of all recorded observation available and pertinent to the subject.

* Chief Engineer, Denver & Rio Grande Western.

It stated further that it will also endeavor to recommend methods by which numerical values of the symbols can be determined, or, failing in this, it will supply proper alternatives to be used for comparative purposes.

This report was accepted without comment.

Records and Accounts

C. C. Haire, Chairman*

The committee presented its report in five subdivisions: Miscellaneous matters; general railway engineering reports and records; maintenance of way reports and records; property records and reports; and accounting practices affecting railway engineering. Following are brief references to the specific subjects given consideration:

Revision of the Manual—In order to bring the specifications for maps and profiles appearing in the Manual into line with present-day requirements and with the new map order of the Interstate Commerce Commission, the committee submitted a revised set of specifications, which it recommended be accepted as information at the present time. Furthermore, acting on instructions to make a thorough review of its material in the Manual, the committee called upon the other standing committees to submit lists to it of the principal or basic forms and records required to complete the Manual, and also information as regards those forms, records, etc., in the Manual that are obsolete and require revision.

Bibliography—Following its practice of previous years, the committee presented a bibliographical review of books, articles and reports appearing from November, 1933, to October, 1934, inclusive, having to do with subjects with which it is concerned.

Office and Drafting Room Practices—Continuing its work of past years in its program of assembling a complete set of standards for drawings and drafting room practices, the committee this year offered seven new sheets. These sheets, which were offered as information, were as follows: (1) Size of drawing sheets; (2) Basis of sizes; (3) Cutting sheets from rolls of tracing cloth; (4) Standard title; (5 & 6) Types and thicknesses of lines; and (7) Arrangement of views.

Joint Facility Records—The committee presented as supplemental to the forms included in last year's report, an additional form—Exhibit No. 1, entitled, Joint Facilities—Register of Recurring Accounts. It stated that the purpose of this form is to provide a running record of bills or vouchers paid or rendered, and to enable the person in charge to tell at a glance whether the bills or vouchers are in arrears or have been paid.

Budgeting Maintenance of Way Expenses—Continuing its study of this subject, on which it reported in both 1932 and 1933, the committee discussed the essentials of any adequate system for the budgeting and control of maintenance of way expenditures, and then outlined a system for forecasting the following month's expense, together with provision for a check of the actual expenditures after the close of the month's accounts. It pointed out that the same system and forms can be used to forecast the expenses of the following year, and to form a check of the actual expenditures made. Three forms were submitted for use in the suggested system, somewhat simpler in each case than required under the I.C.C. primary accounts. These are predicated on a divisional maintenance of way organization, but the committee pointed out that with slight alterations they can be used equally well by a departmental organization.

Methods and Forms for Keeping Property Records Up to Date—The committee offered as Exhibit 1 of its report, the report of the Committee on Valuation Accounting of the Railway Accounting Officers Association, which was adopted by that association in June, 1934. This report includes illustrative completion reports and returns on B.V. Form 588, which have been approved by the Bureau of Valuation of the I.C.C. as representative of the minimum requirements of the Bureau. The committee stated that the report is of particular value as an aid in attaining simplification in the preparation of returns in accordance with Valuation Order No. 3.

The committee also included, as Exhibit 2, two forms for making an equipment completion report, combined with a completion report of property changes and the sub-schedule B in B.V. 588 returns, as was suggested was practical by the Railway Accounting Association.

In a second part of its report, the committee outlined the situation with regard to depreciation accounting with respect to the fixed property of the railways, pointing out that it is indicated that this will become effective on January 1, 1936. It stated that there has been developed, in tentative form, a treatise on this subject, which, when completed and its publication approved by the Board of Direction, will be made available to members of the association.

Changes or Revisions in I.C.C. Classification of Accounts—The committee pointed out that the inauguration of depreciation accounting for equipment in accordance with the Interstate Commerce Commission Order No. 15,100, Depreciation Charges for Steam Railroad Companies, effective January 1, 1935, made it necessary for the Commission to revise certain parts of the effective accounting classification. It then outlined the various revisions and discussed the effect of these changes in the former accounting classifications. It stated that while this matter has to do with equipment accounting, it is of interest to members of the association because the application of the requirements of the depreciation order to fixed property will be a natural sequence.

Other Subjects—Without making report, the committee indicated progress in its study of the following subjects: Recommended practices to be followed with respect to maintenance of way accounts and statistical requirements, and methods for avoiding duplication of effort and for simplifying and co-ordinating work under the requirements of the I.C.C.

This report was received without comment.

* Auditor Capital Expenditures, Illinois Central.

Report on Wood Preservation

F. C. Shepherd, Chairman*

In its report, which covered six subjects, the committee brought up to date the test records on which it has been reporting yearly, and also gave important consideration to marine borer and termite control.

Revision of the Manual—During the year the committee reviewed the association's specifications for creosote and for methods of measuring, sampling and analyzing preservatives, as they appear in the Manual, and found a number of slight discrepancies between these specifications and those of the American Wood-Preservers' Association and the American Society for Testing Materials. To eliminate these discrepancies, which were largely of an editorial nature, and thereby bring the specifications of all three associations in complete accord, the committee revised the Manual material and presented it for adoption.

All of the revisions offered were adopted.

Service Test Records for Treated Ties—Following its regular practice, the committee included in its report the usual table of tie renewals per mile maintained on the various roads, brought up to include the renewals made in 1933. It also presented a series of reports on special tie tests made over a period of years on the Atchison, Topeka & Santa Fe; the Chicago, Burlington & Quincy; the Chicago, Milwaukee, St. Paul & Pacific; the Chicago, Rock Island & Pacific; and the Delaware, Lackawanna & Western.

Supplementing these regular features of its report, the committee presented a review of a paper by Professor J. Liese of the Eberswalde Forestry Experiment Station, on the service life of beech ties impregnated with creosote. The paper, which was based on the record of a considerable number of ties laid in track in Germany in 1897, was reviewed by Dr. Hermann von Schrenk.

Piling Used for Marine Construction—Following its practice in past years, the committee reported on the present condition of the long-time test pieces and other tests prepared and observed by itself, the Chemical Warfare Service, the Sea Action Committee of the Institute of Civil Engineers—England, and other co-operators. It also presented a description of the severe attack of marine borers at hitherto immune or practically immune locations along the New England coast, and of certain other marine borer examinations conducted on the West coast. In summarizing its report, the committee commented as follows:

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The Panama Canal reports continue to show that several tropical timbers have decided resistance to marine borer attack.

The result of tests of the various arsenical compounds prepared by the Chemical Warfare Service do not indicate that they have permanent value, though most of them do show some resistance to attack. The results of these tests are, however, affected by the very evident fact that the test pieces were not properly treated inasmuch as the end penetration is apparently very small as compared to what it should be.

The conditions in New England are a very striking and expensive illustration of the fact that it is not economical to use untreated timber in salt water, no matter what the previous history of the location may have been. Such treated piles as have been used in this territory have generally not received more than a 12-lb. treatment and some of these have been somewhat damaged. The recommended practice of this association calls for treatment of 22 lb. or to refusal for marine piling, and many losses would be saved if this weight of treatment were used.

The New England outbreak calls attention to the desirability of research on the marine borer problem. There has been no comprehensive study of this problem in this country except between 1922 and 1924. If a similar study had been carried on during the last ten years, it is quite probable that much of the loss which the New England railways and others must now face, might have been avoided.

Destruction by Termites and Means of Prevention—The main part of the committee's report was a "high spot" review of the volume entitled "Termites and Termite Control," a 734-page book issued by the Termite Investigations Committee of California. It called particular attention to that part of the volume dealing with the general inadequacy of ground treatments, and quoted the following in this regard:

(1) Ground treatments by themselves should not be depended upon as a fundamental method either for the prevention of termite damage or the eradication of termite infestation. Proper construction and the insulation of all unprotected wood from ground contact is generally conceded to be the best method of preventing damage by subterranean termites.

(2) Ground treatments must still be considered as in the experimental stage. The evidence presented here indicates that at least temporary protection from subterranean termites can be obtained by ground treatments properly applied. We believe, therefore, that further experimentation with ground treatments as a supplemental method, especially with chemicals not poisonous to man, would be justified.

(3) Due to their strongly poisonous nature, sodium arsenite and other arsenicals are not recommended for this purpose. However, if sodium arsenite is used, the health hazard can be reduced and the effectiveness of the treatment increased by the use of larger amounts of dilute solutions (2 per cent and less) and by placing a conspicuous, permanent warning sign showing that the soil has been poisoned.

(4) No effective material has been tested sufficiently to make it possible to state that it will not kill plants.

(5) Periodic inspections of structures to be protected should by all means be continued, whether ground treatments have been applied or not.

The committee also called particular attention to the general recommendations for the control of termites, and the warning issued with reference to the use of arsenical preservatives.

In a second phase of its report, the committee again called attention to the increase in the number of cases where termites have attacked railway structures, citing cases on the Burlington and other roads in the central and northern states, notably, Illinois, Indiana and Ohio, where termites appeared in storehouses, car plants, office buildings, etc. In all these cases, the methods for reconstruction recommended by the committee in its first report, were followed, with excellent results to date.

At the end of its report, the committee discussed the status of the extensive tests dealing with ground poisons being carried out by the R.C.A. Communications, Inc., at Riverhead, L. I. In a number of cases termites were found in poles surrounded by ground treated with poisons. Some of the substances reported as ineffective in keeping termites from the poles are as follows: Anaconda paste; copper sulphate; salt; lead arsenate; naphthalenes; carbon bisulphide emulsion; crank case oil, 5 gal. per pole (10 gal. per pole effective); chlorinated lime; sodium fluosilicate; and aczol. The last mentioned compound, it was said, was used in too weak a solution for a good test.

Incising of Forest Products Materials—Recognizing the necessity for adequate service tests in order to form any conclusions as regards the merits of incising, the committee has attempted to arrange for such tests but has encountered difficulty because of the disturbed conditions on the railways as regards timber purchases. Anticipating an improvement in conditions, however, it reported that it expects to have at least one or two tests under observation during the ensuing year.

Toxicity Value of Creosote and Creosote Mixtures—Fulfilling its assignment to collect information on the toxicity value of creosote and creosote mixtures, the committee presented a bibliography of the more important publications on this subject in recent years, particularly as regards the work of various investigators. To assist the members of the association in ascertaining the general scope of the different publications, the committee offered a series of brief explanations and comments with regard to them.

Other Subjects—The committee reported progress in its study of the following subjects: The effect of preservative treatment using creosote and petroleum, and zinc chloride and petroleum, and the effect on the preservative in treated ties as the result of the blowing off of locomotives when out on the line.

Report on Roadway

Geo. S. Fanning, Chairman*

In a comprehensive report, the committee gave attention to all of its 11 assignments, making recommendations for a considerable number of additions to and revisions in the Manual.

Landslides, Subsidence and Rock-Falls—As its report for the year, the committee submitted a monograph on this subject, prepared for it by Dr. George E. Ladd, consulting engineer geologist, Washington D. C., a member of the committee, and stated that the monograph would be published in a bulletin to be issued after the convention, and would also be included in the 1935 Proceedings.

Railway Fence Wire—The committee continued its study and investigation of wire suitable for railway fences and reported briefly on several types which have been put on the market in recent years, including "Galvanealed" wire, wire consisting of a copper coating welded to a steel core, "Bethanized" wire, and stainless steel wire. As the result of its study of the service life of various types of wire, it arrived at the following general conclusions, which it submitted as information:

(1) That the use of corrosion-resisting metal for the base in fence wire will materially increase the service life of such wire;

(2) Zinc is the most suitable protective coating for wire; and,

(3) The protection afforded by galvanizing is determined by the amount of zinc coating applied uniformly per square foot of surface treated.

Based largely upon the facts which resulted in the formulation of these conclusions, the committee recommended quite extensive revision in and additions to the "materials" requisites in the Specifications for Standard Right-of-Way Fences, in the 1929 Manual. These changes were submitted as a part of its report and were adopted.

Widening Roadbed Under Traffic—Based upon information received from 56 roads, the report of the committee on this subject enumerated the principal methods in use; pointed out the more important factors influencing the proper choice of method and the nature and extent of their influence; described briefly the methods and equipment which have been found effective under the more usual conditions; and called attention to certain features of good practice that are common to nearly all work of this kind. Following are the conclusions arrived at by the committee:

(1) The selection of the most suitable method and equipment for widening roadbed is governed by so many factors that a careful study should be made of each project.

(2) The chief determining factors are; (1) amount and density of work, (2) length of haul, and (3) density of traffic; but other conditions must be given consideration.

(3) The benefit of suitable and efficient modern equipment

* Chief Engineer, Erie.

may often be obtained by renting it or by doing part or all of the work by contract.

(4) The work should be done in such a way as to improve drainage, prevent slides and avoid the formation of water pockets.

Bearing Power of Soils—During the last year the committee made examination of tests and theories reported by many investigators in the field of soil physics and soil mechanics, and, in its report, it gave major consideration to the scope of its examination and to the complexity of the conditions involved in arriving at any definite conclusions of a practical nature. While the committee recognized that much had already been done in the study of soils and their supporting power, it felt that there was still much to be accomplished. This is evidenced in the following, taken from its report:

Laboratory research is necessary to formulate a science of soil physics. Field tests, co-ordinated with laboratory tests, should be undertaken under conditions approximating as nearly as possible the working conditions involved under structures. Mathematical exactness of formulated results cannot be expected, but systematic research may be expected to develop empirical data in practical form for engineering use.

As regards tests related to the general types of foundations common on the railways, the committee is of the opinion that collaboration of the association with some technical institution equipped with special soil-testing apparatus and with staffs trained in conducting scientific research, would prove fruitful of much valuable data.

Adherence to Specifications for Formation of Roadway—In a brief progress report, the committee, on the basis of a limited number of replies received to a questionnaire sent out to the railways, stated its conclusion that the majority of the railways used the A.R.E.A. grading specifications only as a guide. In view of this fact, it recommended that the association's specifications for the formation of the roadway be studied with the thought of making the necessary revisions to bring them into accord with present-day accepted practices.

Adherence to Specifications for C. I. Culvert Pipe—As the result of a questionnaire, the committee found not only that relatively few roads use the association's specifications for cast iron culvert pipe, but that there is a rather general feeling that the specifications should be revised in several respects. In view of this, it recommended that revision of the specifications be undertaken during the coming year.

Service Life of Culverts—Early in 1934, the committee distributed to a large number of roads rating schedules for the various kinds of culverts, together with inspection report blanks and instructions how to assemble the required data. This material was reprinted in the committee's report, together with a tabulated statement of the data received by the committee. This statement, which covered the inspection of 1,159 corrugated metal culverts, 882 concrete pipe culverts, 251 vitrified clay pipe culverts, 2,942 cast iron pipe culverts and 1,716 masonary culverts. showed the following expected life for the various classes: Corrugated metal, 28.1 years; concrete, 47.8 years; vitrified clay, 54.8 years; cast iron, 68.2 years; and masonry, 129.8 years.

Adherence to Specifications for Corrugated Metal Culvert Pipe—Among the facts disclosed on this subject through information submitted by 68 railways, representing a total of 252,925 miles of road, was the fact that roads representing 227,567 miles, or 90 per cent of the mileage reporting, do not adhere to the A.R.E.A. specifications, while roads representing only 20,191 miles, or 8 per cent, use the association's specifications. Roads representing 173,034 miles, or 68 per cent of the total mileage reporting, suggested that the A.R.E.A. specifications be revised. In view of this, the committee recommended that further study be given to the association's specifications with the view of modifying and completing them.

Jacking Culvert Pipe Through Fills—In a thorough review of this subject, which it recommended be approved for publication in the Manual, the committee made the following introductory statements:

Where conditions are suitable, the installation of pipe culverts by pushing them into position with jacks, is safe, fast and will save from 30 to 50 per cent of the cost of placing the pipe in an open trench. The advantages of the method are usually lower cost; no interruption of traffic; and minimum disturbance of the roadbed, with consequently little or no subsequent settlement.

This method is particularly applicable where more than one track is involved, where to fill is high, where the material to be penetrated is clay or similar soil that will arch or stand up well, and where the traffic is heavy. Costs will be higher, although not necessarily prohibitive, in unstable soils and embankments containing boulders, stumps, waste from rock cuts, or similar obstructions.

In the main body of its report, the committee discussed kinds of pipe suitable for jacking; sizes of pipe; direction of jacking; approach trench; unloading and lining up the pipe; the jack set-up; the number of jacks required; the force of men required; jacking procedure; joining the pipe; digging methods; waste disposal; procedure in unstable soils; and the protection of the pipe against percolation and scour.

This material was adopted for inclusion in the Manual.

Protection Against Drifting Sand—Supplementing its report of last year in which it quoted from letters and articles on this subject received from railway and highway engineers in many parts of the world, and then submitted conclusions, which were approved for publication in the Manual, the committee this year presented two additional articles which had been submitted to it for consideration. One of these was received from S. Kurokochi, director, Bureau of Maintenance and Improvements, Japanese Government Railways, and the other was received from Emilio Lenhardtson of Buenos Aires, Argentina.

Revision of the Manual—The committee recommended removal from the Manual of General Contract Requirements on Page 27, as already covered in specifications; the withdrawal of the section on Construction Machinery, Page 49, as too general; and the withdrawal of Specifications for the Construction of Bituminous Crossings, Pages 89, 90 and 91, and the transfer of jurisdiction over this subject to the Committee on Highways. It also recommended several changes in definitions, and in paragraphs under the titles, Tunnels, and Signs, Fences and Crossings. These are in addition to the revisions recommended in the Specifications for Standard Right-of-Way Fences, noted under the report on Railway Fence Wire. These recommendations were adopted.

Report on Standardization

J. C. Irwin, Chairman*

In fulfilling its assignment, the committee reported again on its efforts to encourage the use of A.R.E.A. recommended practices, and of its activities and contacts with other bodies interested in the advancement of standardization. Since the question of standardization is so much in the foreground at the present time, the committee took the opportunity in its present report to repeat its views on the classifications of the material in the Manual with reference to the interests involved, and the limits of the classes of projects in which the value of uniform practice warrants action for national standardization. It then reviewed in some detail the meetings held by the committee during the last four years jointly with officers and other representatives of various organizations interested in standardization, this review including reference to the joint meeting with representatives of the Canadian Engineering Standards Association in Montreal, on May 21, 1934. The purpose of this review was, as pointed out by the committee, to give the association a collective view of the progressive program followed by the committee to the end of establishing closer relations between the association and others having interests in common with it.

The above section of the committee's report was followed by a statement by Frank Ringer, chairman of the Joint Committee on Grade Crossing Protection, A.A.R., with regard to the progress being made in establishing uniform methods of protection for highways crossing railways at grade. Mr. Ringer reported active work on the part of the Joint committee in presenting the association's standards and practices to various interested organizations, and also gratification that these standards and practices have been favorably received.

Continuing its report, the committee discussed the activities of the American Standards Association, and pointed out that

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during the year a new Advisory Committee, consisting of nine outstanding leaders in industry, was organized. It included as appendices a list of standards approved by the A.S.A. during the period September 1, 1933, to September 1, 1934, and also a list of A.S.A. projects on which the railway associations are co-operating, this latter list being designed to bring up-to-date the complete list of such projects reported last year. The committee also included a statement concerning the principal activities during the year of the Canadian Engineering Standards Association, which was prepared by B. Stuart McKenzie, secretary of that association.

This report was received as information without comment.

Report on Highways

J. G. Brennan, Chairman*

The committee presented reports on three subjects and reported progress on three others. The chief interest in the material offered was in the matter submitted for revision of the Manual as reviewed below:

Highway Crossing Signals—The committee recommended the removal from the Manual of all drawings for wig-wag and flashing light signals for location in the center of the highway, and also offered revised drawings for wig-wag and flashing light signals, and for reflector signs for use on such signals, to replace the drawings now in the Manual. The committee also recommended the elimination of the drawing for the advance warning sign and submitted a restatement of the text matter to take these eliminations in drawings into account.

In regard to the installation of signs indicating the number of tracks, the committee offered the following matter to replace corresponding material now in the Manual:

Sign indicating number of tracks to be used where there are two or more tracks. The number displayed on the sign shall be total number crossed, including sidings.

The distance that shall be assumed to separate tracks before an additional crossing sign is considered is 100 ft. unless local conditions require otherwise.

The committee's recommendations were adopted.

Comparative Merits of Various Types of Protection—The committee offered the following comments with respect to various types of grade crossing protection:

Gates: The number of crossings decreased 1,839 from December 31, 1925, to December 31, 1933. The number of accidents decreased 1.42 per cent.

Watchmen: The number of crossings decreased 1,894 in 8 years, and the number of accidents decreased 2.38 per cent.

Signals: The number of crossings increased 7,087 in 8 years, and the number of accidents decreased 2.34 per cent.

Fixed Signs: The number of unprotected crossings decreased 1,217 in 8 years and the number of accidents decreased 0.87 per cent.

This indicates a downward trend in the number of crossings protected by gates and watchmen and a decided upward trend in the use of automatic protection. There was a decrease in the per cent of accidents to the number of protected crossings of all types from December 31, 1929, to December 31, 1933.

The committee also referred briefly, without comment, to four new types of protection, namely, the Auto Stop, an automatic crossing gate, the Blink-O-Light and a flashing Neon light.

Control and Taxation of Traffic Over Highways—The committee had been instructed to report on the action taken by various governmental bodies in the United States and Canada for the control and taxation of traffic over highways, but upon finding that the information requested for the United States had been compiled by the Association of American Railroads' Committee on Relations of Railway Operation to Legislation, the committee confined its report to information obtained from the Canadian provinces and submitted a table giving a fund of information.

Other Subjects—The committee reported progress on the following subjects: Economic aspects of grade crossing protection in lieu of grade separation; recommend specifications for highway crossings at grade over railway tracks; and the difference in costs of highways of various types due to different weights and lengths of trucks.

* Engineer of Grade Crossings, New York Central.

Report on Buildings

G. A. Rodman, Chairman*

In a detailed report covering six of the subjects assigned to it, the committee recommended a considerable number of changes in the Manual and the adoption of several new specifications in connection with railway buildings.

Revision of the Manual—The changes in the Manual recommended by the committee had to do with the heating of medium size stations, Page 265; the location of passenger station signs, Page 267; freighthouse roofs, Page 270; track clearances at freighthouses, Pages 270 and 272; and platform-track distances at ice houses and icing stations, Page 274. The committee also recommended revisions in certain paragraphs in the specifications for railway buildings under Section 10-D, Built-up Roofing; Section 30-A, Steel Chimneys; Section 30-B, Brick Chimneys; and Section 30-C, Reinforced Concrete Chimneys. It recommended withdrawal from the Manual of all of the 19 definitions shown on Pages 263 and 264 of the 1929 edition, these being covered adequately either in the text or in subjects reported upon by other committees. The committee reported that it is giving consideration to the material in the Manual with regard to oil and rest houses, section tool houses, roofings, and floors and paints for railway buildings. The recommendations of the committee were adopted.

Specifications for Railway Buildings—The committee submitted for adoption and publication in the Manual, the following specifications which were submitted as information last year:

Section 30-D, Steel Chimneys (Welded); Section 30-E, Genuine Wrought Iron Chimneys; Section 10-D, Built-up Roofing, Type C-1 (Class 1), Asphalt Impregnated Asbestos Felt and Asphalt (Smooth Surface) Over Wood or Pre-cast Units; Section 10-D, Built-up Roofing, Type C-2 (Class 1), Asphalt Impregnated Asbestos Felt and Asbestos (Smooth Surface) Over Homogeneous Roofs Cast in Place; Section 31-A, Wood Screens; and Section 31-B, Metal Screens. These specifications were adopted.

The following specifications were submitted by the committee as information, for criticism:

Section 30-F, Genuine Wrought Iron Chimneys (Welded); Section 30-G, Reinforced Brick Masonry Chimneys; Section 10-D, Built-up Roofing, Type D-1, Asphalt Rag Felt and Asphalt (Smooth Surface) Over Wood or Pre-cast Units; and Section 10-D, Built-up Roofing, Type D-2, Asphalt Rag Felt and Asphalt (Smooth Surface) Over Homogeneous Roofs Cast in Place.

Bus Terminal Buildings—The committee discussed the occasion for railway bus terminals, the factors determining their location, leasing and purchasing, the conservation of space, types of service (with examples), and elements of design. As the result of its study, which also included such basic factors as finance and operation, the committee arrived at the following conclusion:

Monumental bus terminals are not demanded by the public. Bus terminals including public conveniences and located near centers of population and traffic density, lend themselves more readily to public use.

Under-cover loading and freedom from traffic interference are extremely important factors to be studied in terminal development.

Through lanes of traffic are much to be desired to avoid turning and backing.

Vermin and Ratproofing of Buildings—After presenting a general outline of this subject, in which the committee discussed the damage done by rodents, the losses sustained as a result by the railways, and the places most vulnerable to the entrance of rodents, the committee discussed in detail, with accompanying sketches, methods of ratproofing both new and old buildings of various types of construction and on various types of foundations. Abstracts from its report follow:

It is not sufficient to provide ratproof basements, first floors and foundation walls. Door sills and the lower two feet of doors and jambs should be protected with metal. Window openings, if within jumping distance of some "take-off," should be covered with non-corrosive 12-gage, ¼-in. wide screen. Drains and apertures, including pipe line holes, sewers, flush drains and the like should be protected with wire screen or made tight with ratproof material.

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Foundation walls and basement, and preferably first floors, should be of ratproof material and the foundation walls should extend not less than 24 in. below the ground and to a point 12 in. above the ground or first floor level. The junction of first floors and foundation walls, if of timber construction, should be protected by wire screen on sheathing, and for additional assurance of protection, barriers should be constructed, extending up between the studding from sill or foundation wall to a point two feet above the first floor level. Roofs of buildings, if accessible to rodents, should be protected.

The committee also discussed termites briefly and referred to the work of the Committee on Wood Preservation.

Mill-Type Construction—In a detailed report, the committee collected for ready reference the most recent information on the design of timber columns, walls, floors, partitions and roof structures, as are used in buildings of heavy timber mill construction. The discussion for the most part was confined to matters of engineering practice, since the committee pointed out that two voluminous handbooks on mill-type construction are in the course of preparation by the United States Forest Products Laboratory and the American Forest Products Industries, Inc., and will be published shortly.

The committee's report was presented under the following outline: Progress in the field; further development desirable; solid columns and struts; laminated columns; spaced columns; plank floors; laminated floor decks; composite timber and concrete floors; concrete slab on timber floor beams; beam and girder framing; modern timber connectors; bolt shearing stresses; fire resistance requirements; building design and fire loads; and effective cross-sections.

Economic Value of Materials Used in Building Construction and Maintenance—In a short report, the committee stated that since the availability of labor and materials vary with different locations, it is obviously impracticable to lay down definite conclusions as to what are the most economical materials for use in railway buildings. It pointed out, however, that there are a number of factors which should be given consideration in the determination of the relative value of various materials, and then listed these factors under the six following heads: First cost; maintenance cost; fire safety; social influence and occupancy availability; obsolesence; and expected service life.

Other Subjects—Progress was reported by the committee in its study of the following subjects: Influence of the design of buildings on fire insurance rates; determination of the destructible value of structures which can be collected in case of fire; and the application of stainless and rust-resisting metals to building construction.

Wooden Bridges and Trestles

H. Austill, Chairman*

The committee presented comprehensive reports on four subjects, offered a minor revision to the Manual occasioned by an oversight in the action at the last convention and reported progress on three other assigned subjects. Of the four major reports presented, one related to grading rules and the classification of timbers, another to overhead highway bridges, and two to railway trestle design.

Simplification of Grading Rules. The committee submitted, for consideration during the coming year with a view to adoption at the next convention, a set of General Grading Rules together with related information as a fulfillment of its assignment on Simplification of Grading Rules and Classification of Timber for Railway Uses. In addition to the grading rules, the material offered included uses, sizes, stress-grades and working stresses for joists, planks, beams, stringers, etc., and an exposition of the principles of strength grading. In the opinion of the committee, this new material will greatly simplify the specifications and make for economy in the purchase of structural timber and lumber.

This material was accepted as a progress report.

Overhead Highway Bridges. The report on this subject was presented under three heads. The first of these related to the dimensions of first-class piles for highway bridges, the committee reporting a failure to arrive at a preference either for a table of dimensions submitted tentatively in its report last year, or for a table embodied in "Proposed Revised Tentative Specifications for Timber Piles A.S.T.M. Designation D 25-T" reproduced in its present report. As a consequence, the committee recommended that the selection be made by ballot.

The second part of this report comprised a plan for a timber overhead highway bridge, showing details for both concrete and laminated wooden floors, and was submitted tentatively for future adoption. The third section comprised the report of an experimental study of the load distribution to the stringers of a full-size laminated floor, conducted by W. A. Oliver, associate in civil engineering at the University of Illinois.

This material was accepted as information.

Design of Wooden Trestles. Under this heading, the committee submitted a design for an open-deck timber-frame and wooden pile trestle for E-72 loading. The design is noteworthy in that it embodies details for attaching the stringers to the caps that do not involve drift bolting, and offers an alternative steel-beam cap. A table of comparisons of stresses for different sizes of stringers and panel lengths was also included. This report was submitted for study with a view to future adoption.

Improved Designs to Give Longer Life. One of the most interesting features of the report was a series of drawings of trestle details designed to facilitate the pre-cutting and boring of treated timbers. These included the makeup of stringer chords and 10 different schemes for attaching caps to the piles, together with hardware designed to effect better performance of wooden caps under load. These drawings, together with tables of stress comparisons, were offered as information.

Other Subjects. The committee also reported progress on the following subjects: Bearing power of wooden piles, with recommendation as to methods of determination; recommended relationships between the energy of hammer and the weight or mass of pile for proper pile driving; and design of and specifications for washers, separators, cap-stringer straps and other wooden bridge and trestle fastenings.

* Bridge Engineer, Mobile & Ohio.

Waterways and Harbors

D. J. Brumley, Chairman*

Eight of the 11 assignments of this committee were reported on in some detail, with recommendation for considerable material to be published in the Manual, including 147 definitions of terms.

Specifications for Different Types of River Bank Protection—Last year the committee presented a set of specifications under this assignment, which were referred back to it for modifications and changes. Having made the modifications and changes suggested, the committee this year presented the specifications with the recommendation that they be approved for publication in the Manual. The specifications cover mattresses, stone for ballasting mattresses, dike piling, dike construction, screens, headers and bank revetments.

The specifications were adopted.

Fender Systems for Protecting Wharves—The report on this subject was based largely upon replies to a questionnaire sent to roads and others owning wharves and in a position to advise with regard to fender systems. From the replies received, the committee prepared a tabulation which includes 37 examples of fender systems, together with data on variation of types, cost, service life and other relevant information. The tabulation was not presented as a part of the report, but facts taken from it were discussed in detail under three heads: Types of fenders and their adaptability; species and grades of timber used; and a comparison of first cost, service life and maintenance. The committee recommended that study of the subject be discontinued.

Ore Docks on the Great Lakes—During the last year the committee concentrated its study on ore docks or piers on the Great Lakes designed for loading vessels by gravity. In its report it discussed 15 existing docks of various types and included in tabular form a comparative statement showing the year built, the original costs per pocket and per ton capacity, the 1931 costs of reproduction per pocket and per ton capacity, and the actual annual maintenance costs per pocket and per ton capacity. The report also discussed dock foundations and the service life of

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timber docks and so-called permanent docks, and, in conclusion presented a statement of some of the features which the committee felt should be taken into consideration in the design of docks for ore loading. Briefly, these had to do with the height of hinge hole, pocket doors, the angle of pocket bottom, pocket fronts and the capacity of pockets.

Harbor Structures—The committee made it clear at the outset of its report that its assignment had to do solely with those structures which must be created to provide a harbor and not with structures inside the harbor, such as piers, wharves, buildings, etc. In other words, the report deals with what are commonly known as "harbor works," which, according to a definition presented by the committee are, "the system of engineering structures, jetties, breakwaters, basins, etc., including maintained channels as executed for improving the navigability of a harbor and its availability and security for shipping.

Information collected by the committee, largely from the United States Corps of Engineers, disclosed that harbors are generally divided into three distinct groups, namely: lagoons or bay waters, jetty harbors and sea coast harbors protected by breakwaters. After discussing each of these briefly, the committee made six specific recommendations. Among these it stated that where new harbors are to be developed, or where improvements are to be made in existing harbors by the United States government, there should be close co-operation between the corps of engineers of the United States Army and the railways and public and private interests which are likely to make use of such harbors.

In view of the fact that most harbor works are built by the United States Army Engineers, the committee recommended that the subject of harbor structures be dropped from further consideration.

Clearances Over Navigable Waters—The committee, studying this subject from the standpoint of the economic principles involved, laid stress upon the necessity for giving consideration to all items of cost and damage which may be imposed upon the different parties concerned in an improvement, and not only to those items of expense which are immediately involved in the project itself. To the end of clarifying the situation as to what are the true costs and benefits to be taken into consideration, the committee listed the various elements of cost involved and discussed the different classes of benefits which may be expected to accrue from any project. It recommended that the principles presented in its report be approved for publication in the Manual, and affirmative action was taken by the convention.

Cost to Railways for Construction, Maintenance and Operation of Bridges Over Navigable Waterways—Last year the committee presented a complete report on this subject, taking into account both the bridging of streams in their natural condition, and the additional costs brought about where the capacity of streams are enlarged beyond their natural condition. In that report, the committee set forth a set of principles with regard to the allocation of expense, which it considered equitable. After reviewing these principles during the last year, the committee submitted them for adoption and publication in the Manual. In so doing, it pointed out that it should be borne in mind that the principles suggested are those which are believed to be proper as a matter of equity, but that there may be certain limitations of law which will not permit their application unless and until such limitations are modified. These principles were adopted for inclusion in the Manual.

Definitions of Terms—The committee submitted for approval and publication in the Manual, 147 definitions of terms having to do with subjects with which it is concerned. All of these definitions had been submitted to the association previously for consideration. Except for the deletion of one definition, these definitions were approved for publication in the Manual.

Revision of the Manual—In addition to a number of minor revisions suggested in the Manual, the committee recommended that the specifications for levy construction, as they appear in the Supplement to the Manual, Bulletin 337, and the specifications covering the several types of river bank protection and levies in common use, as they appear in the Supplement to the Manual, Bulletin 347, be withdrawn. The committee's recommendations were adopted.

Other Subjects—Progress was reported, but no written report submitted, with regard to the following subject assignments: Suitable types of construction for levies, dikes and mattresses for use under varying service conditions, giving consideration to stream alinement, sub-surface soil or other local conditions; types of bulkheads, jetties and seawalls, giving cross-sections of each and the purpose which they serve, including comparisons of first cost, service life and maintenance costs of the various types; and the size and depth of slips required for various traffic conditions, including cost of construction and of maintenance.

Clearances Over Waterways—In a supplemental report, the committee called attention to the need for an economic study of the cost of meeting the demands of the government in constructing and maintaining bridges over navigable streams. To aid in this study the committee offered a form for the compiling of data.

Report on Masonry

Meyer Hirschthal, Chairman*

Reports were presented on nine subjects, of which four were submitted for inclusion in the Manual and five were progress reports.

Concrete—Specifications and Principles of Design—The committee submitted for adoption and inclusion in the Manual specifications for reinforced concrete arches for railway loading, including a classification of arches; principles and details of design; and methods of construction, including methods of placing concrete. These were accepted without revision.

Under this assignment the committee also presented, but for information only, detailed plans for a reinforced concrete trestle having 18-ft. spans, designed for Cooper's E-72 loading, and constructed with 24-in. precast, octagonal, reinforced-concrete piles. Progress was also reported on the assignment with respect to rigid-frame structures, columns, floor construction and wind loads.

Progress in Concrete Manufacture—The report on this subject was divided into three sections, the first of which dealt with the recently developed method of transporting and placing concrete by pumping. The machine used for this purpose was described and the advantages and disadvantages of the method were set forth. The second part reviewed the progress in specifications for concrete, beginning with the efforts to obtain a low-heat cement for use in the Boulder dam. It was stated that there are now four specifications in use on important engineering work, which differ materially from the generally accepted standard. The third part comprised tentative specifications for curing concrete, including heat curing and wet curing, and requirements for protection during cold weather.

Specifications for Foundations—The committee presented as a progress report tentative specifications, only partially complete, covering designs of substructures, and construction of masonry. The latter included the placing of concrete in dry and damp foundation pits, pits containing water and pits containing piles.

Lining Railway Tunnels with Concrete—The report on this subject was presented in two parts. The first part, which was submitted for adoption and inclusion in the Manual, comprised specifications for lining new railway tunnels with concrete. This was a revision of the tentative specifications presented in 1934 and included design, methods of placing concrete, other construction methods, and construction and expansion joints. The second part, which was presented as information, discussed the use of steel liner plates for tunnel lining and particularly their adaptation for use in soft-ground tunneling. The economies and other advantages resulting from their use were itemized in considerable detail. As a further development, structural steel ribs have been used with liner plates recently to make the structure self supporting for larger diameters of bore. These specifications were referred back to the committee for further study.

Pneumatically Projected Concrete—Under this assignment the committee presented for adoption and publication in the Manual, specifications for "Shotcrete," which it defined as a material consisting of portland cement, sand and water, placed pneumatically by means of a machine that discharges water and premixed cement and sand, under regulated pressures, through pipes or hose and a discharge nozzle, the water being combined with the cement and sand at the nozzle. The specifications were prepared under two heads—general, and additional requirements for shotcrete protection of structural steel. These specifications were adopted.

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Expansion Joints in Masonry Structures—The committee presented as information and without comment 11 designs of vertical expansion joints.

Revision of the Manual—Under this assignment the committee submitted 43 additional definitions relating to masonry and recommended the revision of three now in the Manual. It also recommended that all of the material now in the Manual relating to the making and driving of premolded piles be withdrawn and replaced with new text which was presented as a part of the report. The recommendations also included the addition of a paragraph to the specifications for girderless flat slabs, to provide for openings in the slabs for elevators, stairways, etc. Extensive revisions and additions were recommended to the specifications covering the distribution of loads to govern the design of railway structures.

This material was adopted with minor revisions after considerable discussion of the subject of live load, leading to the suggestion that the Board of Direction consider the advisability of appointing a special committee to study live loading from the standpoint of its application to all kinds of structures.

Overhead Highway Bridges—The committee reported that a study of the specifications for overhead highway bridges, prepared by the American Association of State Highway Officials discloses the need for extensive revisions to bring them into line with current practice. It recommended, therefore, the appointment of a committee of the association to co-operate with the highway officers in considering a revision of these specifications.

Other Subjects—The committee reported progress in its contacts with the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete.

Report on Waterproofing of Railway Structures

J. A. Lahmer, Chairman*

In a report covering three of its five subject assignments, the committee submitted for adoption a group of principles governing the waterproofing or damp-proofing of railway structures.

Revision of the Manual—The committee offered a definition for plaster coat waterproofing and recommended several minor revisions in the specifications for membrane waterproofing appearing in the supplements to the 1929 Manual.

Waterproofing and Damp-proofing of Railway Structures—In a report based largely on its report on this subject in 1934, the committee presented for adoption a series of nine principles governing the waterproofing of railway structures, and seven principles governing the damp-proofing of such structures, together with notes on the desirable treatment to be given to various classes of structures. The structures considered in these notes include the following: Abutments, piers and retaining walls; short single-span arches and box culverts; pedestrian subways; long single-span arches and multiple-span arches with spandrel fill; precast slabs for bridge decks and floors; cast-in-place concrete bridge decks and floors; pump pits for subways and basements; pipe manholes and pipe tunnels; water containers; walls and floors of buildings; and grain elevator pits and similar underground structures.

The principles promulgated by the committee are given in full in the following:

Waterproofing

(1) Adequate and effective drainage should be provided to remove water from the waterproofed surface if practicable.

(2) Where the range of temperature varies from above freezing to below freezing, the disintegrating effect of frost action on water-saturated masonry must be recognized and adequately guarded against.

Where the temperature does not fall below freezing, the destructive effects of water penetration, but not permeation, by water free from corrosive elements are small. In cases of the passage of small quantities of water through parts of structures not subject to freezing temperatures, waterproofing should be provided only as required by appearance of surfaces or the use of the structure.

(3) Waterproofing should not be applied to the face of masonry subject to freezing and thawing, where water reaches that face through the masonry.

(4) The materials for waterproofing and the methods of application should be such as to insure that the waterproofing will be retained by bond, anchorage or other adequate means, in its original position as applied to the surface to be waterproofed.

(5) Where waterproofing is subject to possible injury from abrasion, pressure, puncture or otherwise, it should be protected with a substantial covering.

(6) Waterproofing should be applied where economically justified, considering the use and probable life of the structure and the cost of obtaining adequate watertightness by design and construction.

(7) The type of waterproofing should be determined by the use and probable life of the structure, and the cost of renewal of the waterproofing:

(A) Waterproofing of the most durable and effective type should be used on permanent structures:

(a) In locations subject to water or other liquids under a hydrostatic head;

(b) Where repair or renewal is impracticable or prohibitive in cost;

(c) Where certainty of watertightness must be had because of heavy damage if water enters.

(B) Waterproofing specially designed for the purpose should be used where the structure must be protected against liquids containing corrosive and/or disintegrating substances.

(8) A waterproofing membrane on the surface adjacent to the water source is the most effective externally-applied waterproofing, but difficulties of application and prohibitive cost may sometimes make consideration of some other method advisable.

(9) Surface applications on the inner faces of walls for the purpose of waterproofing against external pressure must derive their effectiveness from bond with the masonry or from closing the surface pores. Such applications can generally be considered effective only to prevent seepage under little or no head. Such coatings must be insoluble and unaffected by dampness.

Damp-proofing

(1) Damp-proofing is effective in preventing the accumulation of surface moisture from condensation only in proportion to its temperature-insulating value.

(2) Damp-proofing will probably not be effective where masonry is subject to moisture saturation accompanied by cycles of freezing and thawing.

(3) Ordinary damp-proofing is not effective against cracks or openings through the masonry.

(4) A frequent fault of one-coat damp-proofing is failure to produce a continuous covering free from pin holes. This should be considered in deciding upon the number of coats that should be applied.

(5) The purpose and character of damp-proofing are not such as to require special protection or covering. Where protection or covering is necessary, the conditions will usually warrant the use of waterproofing.

(6) A prime requisite of damp-proof covering is that it shall stay in place. Bond with the surface is therefore essential.

(7) The selection of materials for damp-proofing must include consideration of the effect of extremes of temperature, the effect of the sun's rays, and the physical and chemical effects of the liquid to which they will be subjected.

This subject was referred back to the committee for further study.

Bituminous Emulsions—In a progress report, the committee presented a general discussion of the adaptability of bituminous emulsions for damp-proofing many types of railway structures; the various types of materials available; and the methods which should be employed in the application of these materials. In this discussion, it covered more particularly the essentials and advantages of suitable emulsions; asphalt used in emulsions; the process of emulsification; bituminous emulsions containing fibre; preparing the surface for treatment; application; and the effect of temperature during application.

Other Subjects—The committee reported progress in its study of the following subjects: Waterproofing and damp-proofing as applied to existing railway structures; and specifications for materials and workmanship for the use of plaster coat and metallic coating for waterproofing and damp-proofing.

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Signal Section Convenes in Chicago

H. G. Morgan
Illinois Central
Chairman

Program of two-day annual meeting dealt with economics of yard signaling, highway crossing protection, "call-on" signal aspects and instructions for signalmen

G. H. Dryden
Baltimore & Ohio
Chairman-Elect

EXPLANATIONS of signal aspects, studies of economics, and specifications for colored glasses were outstanding features of the forty-first annual convention of the Signal Section, A.A.R., at the Stevens Hotel in Chicago on Monday and Tuesday of this week. H. G. Morgan, signal engineer of the Illinois Central, presided at the meeting, the program consisting of the reports of 11 standing committees. The attendance at the meeting was 341, an increase of 26 over that of last year. R. H. C. Balliet, secretary, reported the membership in the Section to be 1,796, the additions during the year being 92. A total of 70 committee meetings were held during the past year.

In presenting the report of the Committee on Signaling Practice, P. M. Gault (M. P.), chairman, introduced S. N. Mills, assistant director of the Bureau of Safety, I. C. C., who spoke at some length on the train-control situation and offered several suggestions as to means of reducing the number of train accidents. Abstracts of Chairman Morgan's opening address and Mr. Mills' remarks follow.

Address of Chairman Morgan

We are here to review another year's work of the Signal Section. The standardization work of the committees may be roughly separated into three classifications: (1), signal standards, which concern this Section only. These are your very own; they should meet your every requirement; (2), joint standards which are developed in co-operation with other bodies in the Association of American Railroads. These are the result of negotiation and compromise by your committees. They should sacrifice no essential signal requirement but allowance must be made for the requirements of other bodies whose requirements are not identical with yours; (3), national standards, adopted by outside organizations such as the American Standards Association, which are designed for interests greater than ours. You should use them if they can be made to meet your needs.

Summarizing these, we have signal standards to meet every signal requirement; joint standards to meet essential signal requirements while, likewise, meeting those of others in the A. A.R.; and national standards to be adopted wherever practicable. Your work of review will be facilitated if these distinctions are kept in mind. The past year has afforded little new work except in the field of protection for crossings with highways. The standard crossing signals developed by the Signal Section have been gaining increased recognition by national and state highway authorities and state railway commissions. You can assist in the national standardization of highway crossing signals by rigorously adhering to standards in your own installations, and in your negotiations with highway and state authorities. In this, as in all other Signal Section matters, standardization is not accomplished by your letter-ballot approval; it is only begun. You must follow through.

Remarks of S. N. Mills

In connection with installations of automatic train-stop, train-control and cab-signal devices, the monthly performance reports and our periodical inspections indicate, with but few exceptions, a high standard of maintenance. On some roads the number of movements made with non-equipped locomotives has been materially reduced. In the few exceptional cases, one or two of which are somewhat glaring, false restrictive operations are far too numerous, and cut-outs en route are much more frequent than would be the case with a proper standard of maintenance; this results not only in unnecessary interference with the movement of traffic but also in failure to obtain in full the protection available.

During 1934 the Bureau of Safety, I. C. C., investigated 77 accidents, of which 31 occurred in automatic block-signal or interlocking territory. However, in not one of these cases did the investigation disclose any failure of the signals involved, to function properly or to display the proper indications; 10 of the accidents investigated were in territory where automatic train-stop, train-control or cab-signal devices were in operation, and in none of these cases was there any failure of this apparatus.

The automatic train-control order of June 13, 1922, provided that the apparatus should be so constructed as to prevent the release of the brakes after automatic application until the train has been brought to a stop, etc. . . . To conform to this requirement, the practice was adopted by certain carriers, of so locating the reset switch that the engineman or fireman was required to get down on the ground to effect a release. This practice had subjected enginemen to certain additional hazards. The purposes intended by the original requirement could be accomplished by placing the reset switch in another location. Therefore, the order was modified to permit the reset switch to be removed from its present location and to be located under the hood at the back of the cab where it can be reached from the gangway between the locomotive and tender.

Two instances of increased hazard, due to the location of the reset switch at a point where it can be operated only from the ground, have recently come to our attention. In one case, a rear-

end collision occurred after the first train involved had been stopped by an automatic brake application; the delay in again getting under way was increased to some extent by the fact that the fireman was required to get down on the ground in order to reset the apparatus before the brakes could be released. In the second case, the train was stopped at night on a narrow bridge and the fireman, in getting down to reset, fell into the water and drowned. This matter merits the consideration of each railroad which has equipment of this character in service.

Forestalling Devices

At previous meetings, attention has been directed to accidents which have occurred after enginemen have operated the forestalling devices of automatic train stop systems so as to prevent an automatic application of the brakes, and then have proceeded without keeping their trains under proper control as required by the rules. During the past year, two serious accidents of this character were investigated, namely, the New York Central accident at Crugers, N. Y., and the Boston & Maine accident at Ayer, Mass. In both of these cases the speed, after receiving approach indications, was not sufficiently reduced to enable the trains involved to be stopped before over-running the stop signals and colliding with preceding trains.

Most railroads have now adopted the present Standard Code requirement which is designed to establish a medium speed limit, or half-authorized speed limit, when an approach signal indication is received, and usually this is supplemented by a rule that forestalling devices must not be operated until the restrictive signal indication is seen and is being obeyed. The adoption of these rules was an important step toward increased safety in railroad operation; nevertheless, the facts brought out by a number of accident investigations have directed attention to the need for more effectively enforcing compliance with the requirements of the approach indication.

In many investigations of accidents of this kind, the evidence points strongly to the conclusion that the engineman *assumed* that the approach indication was displayed because of some particular condition which he thought existed ahead, and was proceeding upon the assumption instead of controlling his train in accordance with the requirements of the signal indications which were actually displayed for his train. A further long step toward improved safety will have been taken when both *operating officers* and *enginemen* come to a full realization of the fact that the speed restrictions, which are imposed by approach signal indications, are just as definite and positive in their requirements as is the requirement to stop for a stop signal.

Numerous Speed Restrictions

In other cases of this character it appears that the rate of speed was underestimated or braking was not started soon enough. Let us consider for a moment the speed restrictions which are currently in effect on railroads in this country. Speed restrictions are imposed for maximum speed, permissible speed on curves of different degree and elevation, through crossovers, switches and turnouts, through city limits, over bridges and track undergoing repair, and varying rates of speed are required under the different restrictive signal indications. A check of the time-table and rule book covering the operation of trains on one railroad division disclosed speed restrictions of 4, 5, 6 and 10 m.p.h. and for all multiples of 5 to and including 70 m.p.h.; on bridges speed limits of 10 m.p.h. and all multiples of 5 from 25 to 65 m.p.h., and on curves varying from 20 to 60 m.p.h. On another road the restrictions began at 6 m.p.h. and included multiples of 2 up to 12 m.p.h., then multiples of 5 up to 50 m.p.h. and multiples of 10 up to 70 m.p.h.

Furthermore, the observance of many of these prescribed speed restrictions is essential to the safe operation of the train itself without reference to following, opposing or otherwise conflicting traffic, and in some cases but little margin of safety is provided by the prescribed speed restrictions. In one case which came to our attention, as a result of reduction in curve elevation, a maximum speed limit of 45 m.p.h. on a curve was prescribed, whereas, in view of the curvature and elevation, the maximum theoretically safe speed on this curve was 46 m.p.h. Following the investigation of this accident, the speed limit was reduced, but only to 40 m.p.h.

Many enginemen are extremely expert in estimating speed, but this is not a characteristic of men, and it is scarcely to be wondered at that, after running for considerable distances at high speed, even enginemen of long experience and excellent qualifications occasionally get into difficulty as a result of errors in judgment as to the extent of speed reduction required when approaching or entering the territory where any one of the multitude of current speed restrictions is prescribed.

While it is true that the speed restrictions impose only maximum limits, nevertheless, in view of the urge for speed and the maintenance of fast schedules, the limits so prescribed usually come to be regarded as the required rates of speed, and it is not reasonable to expect that all enginemen can accurately gage speed in accordance with precise requirements.

In view of these facts, a suggestion may be appropriate that serious consideration be given to the equipment of locomotives with speed indicators. I do not mean speed recorders to be used for checking up on the performance of enginemen, but speed indicators which will provide a means whereby enginemen can comply with the various speed restrictions which they are required to observe. There are approximately 23,000,000 automobiles in the country on which speed indicators are standard equipment. An automobile driver would hesitate to drive a car without a speed indicator. Of the approximately 50,000 locomotives in service in this country, only a small number are equipped with speed indicators. On some roads passenger engines are now so equipped, and speed indicators are being provided on some new locomotives as well as on the high-speed, light weight, streamlined trains which have attracted so much public attention. As schedule and maximum speeds are increased, the need for such devices becomes more pronounced and apparent; their general adoption would make it possible for enginemen to adhere more closely to the requirements of restrictive signal indications.

Signals Should Be Respaced

Perhaps it may not be out of order to direct attention to the need, in connection with faster schedules and increased maximum speed limits, for checking up on the spacing of signals and making necessary revisions to insure that adequate stopping distances will be provided under all circumstances. While, no doubt, this has been done where radical changes in schedules have been made and where ultra high-speed trains have been placed in service, instances have come to our attention where schedules have gradually been speeded up and maximum speed limits increased with no corresponding changes in signal spacing or indications, until the margin of safety provided by the signal system is, in some locations, no longer adequate for current operating practices.

Report on Economics of Signaling

The report of the Committee on Economics of Signaling, presented by B. J. Schwendt, (N. Y. C.), chairman, included discussions of the use of signaling to expedite trains and cars in yard and terminal areas; signal protection for light-traffic railroads crossing at grade; train operation—single-track versus double-track; and economics of changing from automatic train control to automatic cab signals.

Yard Signaling

The first part of the report was devoted to an extended explanation of means of using signaling to expedite yard and terminal train movements. Except in a few instances, the statistics on freight movements show that improvements in yard performance since 1921 have been small as compared with reductions in road time. The report continued with a discussion of several means of improving yard operation, portions of which follow:

Car Retarders

One of the principal sources of delays in classification yards is the handling of yard switches by hand and the use of hand brakes operated by car riders to control the speed when cars are running down the hump to the classification tracks. By 1932 the car-retarder system, including equipment for the operation and control of the switches, as well as devices for controlling the

speed of cars had been installed in 37 yards by 31 railways or companies, involving 1,125 classification tracks, 1,020 retarders, 1,147 switches, 565 skate machines, and 92 control stations.

As the result of a questionnaire, 12 railways reporting on 16 car-retarder installations showed economic results as follows:

1. The savings in operation per car handled through the various yards ranged from a maximum of $0.55 to a minimum of $0.087.

2. The average annual return on the capital investment on the 16 installations was 42.68 per cent.

3. The average cost per car handled through the yard before the retarders were installed was $0.80 and after they were installed, $0.52, representing an average saving per car handled of $0.28. The average reduction in classification costs in the 16 yards is 35 per cent.

4. Four of the railways reported that the retarders had resulted in eliminating switching at other points.

5. The installations have been in service for periods ranging from slightly over 2 years to approximately 9 years, an average of 5 years. If the same rate of return were applicable throughout the periods that the retarder systems were in service, these 16 installations up to January, 1934, have brought about savings, after deducting maintenance, operating and interest charges, of approximately $15,000,000 on an investment which aggregates slightly less than $10,000,000, or have paid for themselves one and one-half times.

6. The economic results reported indicate that it is not necessary to have a large volume of business for retarders to pay their way as one yard with a daily movement of 768 cars showed a return on the capital investment of 37.83 per cent and another, with only 900 cars daily, showed a 69 per cent return. Experience has shown that a low level of 603 cars per day at one yard and 643 cars at another yard was sufficient to provide favorable economic results.

Centralized Traffic Control

Centralized traffic control is particularly effective on terminal railroads where there are a number of junction points and the average train haul is short. Centralized traffic control effects a saving in train time by bringing the operations directly under the control of an operator and provides for the movement of trains by signal indications without written train orders.

Some notable installations of centralized traffic control in terminal areas are on the Paducah & Illinois between Metropolis, Ill., and Paducah, Ky., and on the Peoria & Pekin Union between Peoria and North Pekin, Ill.

Spring Switches

Spring switches are used to advantage at points where the trailing movement, as well as the facing movement over the switch, is at low speed. They are also used at junctions of yard leads with main tracks, in which case they are equipped with a full complement of signals to govern movements over the switch and to provide for safety of the higher speed movements. Many of these switches are on double track where facing movements are seldom made. The development of a mechanical facing-point-lock has resulted in this type of yard exit switch being installed in places where it was previously thought undesirable because of high-speed facing-point movements.

Remote Control

Remote control is adaptable to points where freight trains enter or leave yards, and where it is more expensive to provide switch-tender service or to stop trains. It may also be used to advantage at ends of double track in yard territory. Small intermediate yards, with relatively few tracks, can often economically be equipped with remote control because a decrease in train stops will more than pay for the cost of the installation. In larger terminals, remote control is used to replace switch tenders or local interlocking plants.

The economic value of power-operated turnouts depends upon the saving brought about by the avoidance of stopping and starting trains that could pass over the power-operated switch without stopping. To determine whether it is advantageous to provide for power operation of a switch, a comparison should be made of the cost of stopping and starting trains, together with payroll cost of operating the switch by other means, as against the sum of the maintenance, operation, and fixed charges resulting from the power installation.

The following tabulation shows the comparative costs of five methods of operating an outlying switch 5,000 ft. from an existing station as determined from detailed estimates on one railroad.

Methods of Operating a Facing Point Switch

Switch operated by	With	Total first cost	Total annual cost
Trainmen	No signals	....	$7,300
Switchmen	One approach signal	$1,806	5,467
Switchmen	One home and approach signal	3,356	5,976
Mechanical interlocking	Five signals	7,308	7,182
Power operation	Five signals	11,191	2,397

This tabulation indicates that, at the density of traffic where the cost of operating the switch by trainmen amounts to $7,300 per year, any of the other schemes would be productive of savings. The relative superiority of using the power operation is clearly indicated. It is also apparent that power operation would be profitable at a density of traffic substantially below that at which the costs of stopping and starting trains at the switch were estimated at $7,300.

Other means of improving yard operation and train movements in the vicinity of yards, explained in detail in the report, included automatic block signals, grade signals, consolidation of interlockings, annunciators, automatic cab signals, audible signals, yard track indicators, and train indicators.

Sub-committee chairman, C. A. Taylor (C. & O.) presented the report on yard signaling, explaining that, considering the United States as a whole, a reduction of 36.4 per cent in hours per 100,000 gross ton-miles was made in road-time of freight trains in the period from 1921 to 1932, whereas a reduction of only 11.5 per cent was made in switching locomotive hours per 100,000 gross ton-miles. He then explained in detail the applications of various types of signaling for reducing yard delays, as given in the report.

Signal Protection for Light-Traffic Railroads Crossing at Grade

An abstract of the report on signal protection for light-traffic railroads crossing at grade follows:

In recent years changing railroad conditions have brought about the necessity for simpler signal protection at crossings of main and branch lines where traffic conditions do not warrant the usual type of attended mechanical or power interlocking. The large number of automatic interlockings installed in the past 12 years (505) has shown the desirability of adopting simple signal arrangements at grade crossings, not only to replace stop signs and target signals, but also to replace interlockings as renewals become necessary and where traffic conditions warrant the simplified layout. The increasing necessity for eliminating train stops at unprotected grade crossings; the desire for increased freight train tonnage and increased speed between terminals; and the necessity for reducing maintenance and transportation expenses, providing more economical and efficient train service, have brought about many simplified installations.

The report showed that first cost varied from $460 for the simplest type of layout as installed on the Alton at Minier, Ill., which included one- and two-indication home signals without approach signals, to $9,700 for a layout on the Chicago, Burlington & Quincy at Virden, Ill. Several of the more costly installations included the abandonment of the original interlockings, while 22 installations included fixed approach signals. Where manually-operated interlockings were replaced with simpler plants, the annual cost of maintenance and operation was reduced from a maximum of $6,000, at a three-trick plant, to a minimum of $200. At 12 interlockings, the cost of maintenance and operation formerly averaged $3,844 per year, as compared with an average

of $334 with the new signaling, a reduction of 91.3 per cent. The saving on 33 installations varied from 23.6 to 1,261 per cent.

The installation of six automatic interlockings on the Chicago, Milwaukee, St. Paul & Pacific between Aberdeen, S. D., and Mitchell, 128.6 miles, eliminating stops at six crossings, has resulted in the average freight train running time being reduced 77 min., or 14.6 per cent per trip. The average freight train speed was increased from 14.7 to 17.1 m.p.h. or 16 per cent. While passenger train schedules have not yet been increased, it is now much easier to make up lost time, and there is a saving in fuel in passenger service of about 1,500 lb. per trip. Freight train loadings have been increased about 170 tons per train with no change in the power used. This increased train load is being handled in less time and with less fuel than formerly, bringing about a substantial saving.

L. S. Werthmuller (M.P.) sub-committee chairman, presented the report on signal protection for light-traffic railroads crossing at grade, explaining that the recent developments in the application of this type of signaling to more complicated layouts warranted a reconsideration of this phase of signaling as a means of expediting train movements and reducing operating expenses.

Single-Track Versus Double-Track

The report on train operation—single-track versus double-track, presents in detail with diagrams the change made on a certain railroad where 5.8 miles of the westward track of a double-track line had been removed. The automatic signaling was rearranged for single-track operation and two signals were added. The summary of the report follows:

Converting 5.87 miles of double track on a 6.4-mile line as reported herein, is estimated to effect the following results:

First—Expenditures and credits for track and other changes:

(a) Required a cash expenditure of $8,277.
(b) Reduced capital account by $78,362.
(c) Showed a profit and loss expense of $51,461.
(d) Showed a credit of $32,990 for salvaged material.
(e) Resulted in a net credit of $24,713.

Second—Decreased cost of maintenance:

(a) On about 6 miles of second track removed.
(b) On a bridge.

Third—Effect on train operation:

There has been no appreciable change in the cost of train operation due to the light traffic on this territory and trains being governed by automatic block signals under both double and single track layouts.

Train Control to Cab Signals

Five carriers, the Delaware, Lackawanna & Western, the Long Island, the Norfolk & Western, the Pennsylvania, and the Union Pacific have, under authority from the Interstate Commerce Commission, installed automatic cab-signal devices in lieu of automatic train control previously installed in conformity with orders of the Commission. The report presented by the committee included complete statements as to the economies effected by this change on each of the roads. For example, the installation on the Union Pacific extends from North Platte, Neb., to Cheyenne, Wyo., 225 miles of double-track line, and 137 locomotives are involved in the change. The cost of the change from train control to cab signals on this territory is tabulated as follows:

(a) Roadway	$7,025.87	
(b) Locomotives	12,402.61	
(c) Total		$19,428.48
Net Saving per Annum:		
(a) Roadway	$480.00	
(b) Locomotives	49,731.00	
(c) Total		$50,211.00

Annual Return on Expenditure:
50,211.00 ÷ 19,428.48 or 258.4 per cent.

Report on Highway Crossing Protection

The report of the Committee on Highway Crossing Protection, presented by A. H. Rudd (Penna.), chairman, included recommendations for revisions in the requisites for highway crossing signals, an explanation of the developments of highway crossing protection, and a statement as to the federal and state activities in the crossing protection field. Abstracts from the report follow:

Developments on Highway Crossing Protection

After a year or more of committee work, the National Conference on Street and Highway Safety adopted a new uniform act regulating traffic on highways. The important features pertaining to railroad crossings were the inclusion of the railroad sign or signal in the same class as the official traffic control devices, making it unlawful for anyone to place, maintain or display upon or in view of any highway any unauthorized sign, signal, etc., which is an imitation of or resembles any such signal, or which hides from view or interferes with the effectiveness of any railroad sign or signal. The act provides for obedience by the public to signals indicating the approach of a train; requiring that vehicles shall stop within 50 ft. but not less than 10 ft. from the nearest track, and shall not proceed until they can do so safely.

The report of the Joint Committee of the Conference and the American Association of State Highway Officials was approved by the Conference and has been adopted almost without change as the new Manual by the American Association of State Highway Officials.

In the Manual on Signs, provisions have been made for a railroad advance warning sign, to be located along each approach to every railroad grade crossing except that of a minor siding or spur, and for railroad crossing signs on each side of the track at every railroad grade crossing except that of a minor siding or spur. The Manual states: "Railroad crossing signs are usually on the railroad right-of-way and are furnished and placed by the railroad company. Railroad advance warning signs are usually off the railroad right-of-way and should be the responsibility of the highway authorities.

The railroad advance warning sign was changed as follows: Diameter, 30 ins.; reflecting buttons outlining the shape of the sign or signs to be placed on the yellow background just inside the black border; instead of the vertical black cross, the cross is a miniature of the right-angle crossbuck sign, railroad standard, with the letters "RR" at the sides, these letters also to be equipped with reflecting buttons.

The Manual established the principle that the flashing red light means stop and then proceed when safe. Provision is made for a sign showing the number of tracks if more than one, and the Stop When Swinging and Stop on Red Signal signs, or the vertical STOP in electric lights, as provided in the A.A.R. standards.

In the part of the report dealing with signals, the Manual states: "Traffic-control signals shall not generally be used as alternatives to train approach signals except where streets intersect at or close to the railroad crossing, and then only where observance is enforced by police authority. When used, both sides of the track shall be adequately protected by signal faces.

The Association of State Highway Officials approved the Signal Section recommended practice for train approach signals; namely, (a) flashing-light type and (b) wig-wag type.

Federal and State Activities

The report concerning federal and state activities reviewed the legislation and progress made in the installation of highway-railroad crossing signals at the expense of the public works funds. As these developments have been covered currently in the *Railway Age*, and dealt with in detail in an article in the issue of March 9, the report as printed in the advance notice is not given here.

The Committee expressed the opinion that "the use

of the reflector-button crossbuck should be confined, at least for the present, to locations where signals are not provided, and that, where the states will permit, the crossbuck mounted on the mast with the signal should not be reflectorized."

Chairman Rudd presented the report, giving an extended explanation of the information concerning developments of crossing signal protection. He stated that complaints had been received of phantom indications on flashing-light signals, and suggested that the members give this matter attention. He also suggested that the members of the Signal Section urge the officers of their railroads to contend for the adoption of A. A. R. standard signals when dealing with public authorities regarding proposed installations.

Report on Signaling Practice

The report of the Committee on Signaling Practice, presented by P. M. Gault (M. P.) chairman, included an explanation of the status of automatic train control and cab signaling on the railroads; a report on reflecting devices as a substitute for oil or electric lamps on switch stands, slow-order boards, etc.; an explanation of the location of home signals at interlocking plants; a report on signaling for gravity classification yards; and a report on the use of call-on signals, an abstract of the latter report being given herewith.

In presenting the report on the status of train control, Chairman Gault introduced S. N. Mills (Bureau of Safety) whose remarks are given elsewhere in this article. In discussing Mr. Mills' statements, Chairman Gault explained that he himself had recently made an extensive study which proved that the number of train accidents resulting from defective operation of signal apparatus was so small as to be practically negligible. The requisites for signaling for gravity classification yards called forth considerable discussion, C. F. Stoltz (C. C. C. & St. L.), N. S. Brown (G. R. S. Co.) and H. S. Loomis (U S. & S. Co.) offering objections to the aspects and indications recommended by the committee. G. K. Thomas (A. T. & S. F.), suggested certain aspects which were accepted by the committee. Then discussion arose as to the explanation of the indications and L. S. Werthmuller (M. P.) offering a wording acceptable to the committee. The revised aspects suggested by Mr. Thomas, and the indication offered by Mr. Werthmuller, as shown in the accompanying table, were adopted for submission to letter ballot for inclusion in the Manual.

ASPECTS AND INDICATIONS FOR HUMP SIGNALS

ASPECT	INDICATION
Red	Hump
Yellow over yellow	Hump medium
Yellow	Hump slow
Flashing red	Back up

Use of "Call-on" Signals

A questionnaire was sent to all Class-I railroads to determine the present practice in the use of the so-called "call-on" and other "restricted speed" signals at interlocking plants, and also as to the use of automatic block signals at interlocking limits for movements leaving the plant. This report has been prepared from information received from 36 railroads, and represents the major number of interlocking plants and miles of automatic block signals in service in the United States and Canada.

Use of "call-on" signal at interlocking plants—Out of a total of 36 roads from which reports were received, 30 state that they are using the "call-on" signal under various conditions. There are various types of aspects and indications used for this purpose, divided as follows:

19 roads use restricting signal, standard code rule 290.
14 roads use caution slow-speed signal.
5 roads use stop-and-proceed signal.
1 road uses dwarf signal.
2 roads use low-speed signal.

A few of the reporting roads state they use more than one type of signal for this purpose.

Practice with regard to whether trains are required to stop before the "call-on" signal can be passed.

(a) Entering an occupied block.
22 roads report stop is not required.
13 roads report stop is required.
1 of the roads included under the list showing "stop not required" reports that "stop" is required after the train has passed through the interlocking plant.
*1 road reports "stop" is required in single-track territory but not in double track.
*1 road reports "stop" is required where passenger trains are involved but not for other than passenger trains.

Note—Some roads require "stop" in certain sections and not in others, depending upon the type of signal used or whether on single or multiple tracks.

(b) Movements from main to other tracks.
26 roads report stop not required.
5 roads report stop is required.
1 road reports that such signal is not in use.

* These roads are included in the group showing "stop not required," as well as in the group showing "stop required."

Possibility of train delays where stops are required—Some roads report no appreciable delay to trains as a result of following the practice of requiring them to stop, while others state the practice does cause considerable delay. One road states that in terminal zones and at other points where the stopping of trains at such signals would result in considerable delay, it is their practice to place an automatic block signal at the leaving end of the plant so that the "call-on" or other "restricted speed" signal governs only through the limits of the interlocking.

Aspects displayed by interlocking signals for movements from a main track to a non-track-circuited siding and for "call-on" for main track movements—25 roads report the same aspect is used for both movements.

Method of control of so-called "call-on" signal—In the majority of cases a separate lever is used for the "call-on" signal, but where it is not provided a pushbutton control is employed in addition to the lever. Where a separate lever is used for the control of the "call-on" signal the rules require the operator to use such lever only when the route is occupied. However, where the same lever is used for all the aspects displayed by the signal it is the general practice to use a pushbutton, in addition to the operation of the lever, to have the signal display the "call-on" indication.

Rules or special instructions in effect governing the movements of train by the restricting "call-on" signal—The rules pertaining to the movement of trains by such signals, as well as the indications displayed by them, vary considerably on the different railroads, as will be noted from the following:

Proceed at slow speed prepared to stop.

Proceed at not exceeding 15 m.p.h.

Proceed at slow speed prepared to stop short of any obstruction.

Proceed prepared to stop short of train, obstruction, or anything that may require the speed of a train to be reduced.

Proceed at restricted speed.

Proceed at not exceeding 10 m.p.h. prepared to stop short of a train or obstruction, or anything that may require speed of train to be reduced.

Enginemen accepting restricting-speed signal (call-on arm) for movement to the next signal ahead, if any, will proceed with caution, under control, prepared to stop, and only as the way is seen or known to be clear.

Trains must stop and may then proceed under automatic block signal rule.

Stop, then proceed at slow speed and when on main track beyond the limits of the interlocking plant be governed by block signal Rule 513.

The restricting signal may be used only when it is necessary

that the speed of the train be restricted. Signalmen will not display this signal until it is seen that the train governed is moving at restricted speed, and that it is safe to advance the train by its use.

Proceed at slow speed.

When lower arm of three-arm interlocking home signal displays "Proceed with caution" indication, train may pass home signal and proceed under low speed.

(Double, Three, or more Tracks)—In automatic block system territory, when a train is stopped by a stop-and-proceed signal that governs its movement into or within an interlocking it may proceed at once not exceeding 15 m.p.h. to the next signal, expecting to find a train ahead, broken rail, obstruction, or switch not properly set.

Signalmen must not admit a train to an occupied track between a home signal and the next signal in advance without first stopping the train.

Where there is a home signal located in the rear of a block signal, and both signals are controlled by the same block station, the signalman must not admit a train to the route between those signals while it is occupied without first stopping the train, and then only by signal aspect indicating "Proceed at not exceeding 15 m.p.h. with caution prepared to stop short of train or obstructions," or by train order.

When the top light or arm of a two-unit signal or the top or middle light or arm of a three-unit signal cannot be cleared for a main-track movement, after the train has come to a full stop, the signalman may allow the train to proceed on a restricted speed signal under Rule 290.

Proceed at not exceeding slow speed (10 m.p.h.) expecting to find a broken rail and prepared to stop short of train, obstruction, car fouled, or switch not properly lined.

When a train or engine advances on a dwarf or "call-on" signal indication at *any* interlocking plant, it must proceed at restricted speed prepared to stop short of train or other obstruction but not to exceed 12 m.p.h. while moving through the interlocking plant limits; also, in automatic block signal or automatic train speed-control districts, if moving into and through an automatic block beyond the interlocking plant limits on a main track assigned to the movement of scheduled passenger trains, the speed of the train or engine shall not exceed 12 m.p.h. until subsequent signal indications permit increased speed. A speed restriction of 12 m.p.h. must also be observed when a train or engine advances on a dwarf signal or "call-on" signal indication in connection with an automatic block signal, governing train movements through an automatic block on a main track assigned to the movement of scheduled passenger trains.

(A part of the report explaining the use of dwarf signals for call-on indications is here omitted.)

Use of automatic block signal at the leaving end of interlocking plants—There is a considerable variance in the present practice as reported by various roads, some roads stating that they place an automatic block signal at the leaving end of the interlocking in districts where the blocks are short. Others state they used them in old installations but have not been following this practice in recent ones.

Other Committee Reports

The report of the Committee on Interlocking included revised specifications for an electric lock, a mechanical time release, interlocking lever circuit controllers and a car-retarder system. A progress report was presented relative to locking tolerances for rail-locking devices used on interlocked drawbridges, and relative to the methods of protecting railroads crossing at grade where traffic conditions do not justify an interlocking plant. The latter includes seven schematic drawings with suitable descriptions of each railroad-crossing situation involving the use of gates, locks, indicators, derails, smashboards, signals or signs in combinations, depending on the operating conditions.

The report of the Committee on D-C. Automatic Block Signaling comprised a revised specification for the D-C. Vibrating Highway-Crossing Bell, and a discussion of the development and application of the d-c. coded-track-circuit control system for either wayside or cab-signal installations or both, together with a typical circuit plan and an illustration showing the track-circuit equipment.

The report of the Committee on Instructions consisted of revisions of the Instructions for the Installation, Maintenance and Operation of Nickel-Iron-Alkaline Storage Batteries, Instructions for Inspecting and Testing Alternating-Current Relays and Indicators, and Instructions for Inspecting and Testing Direct-Current Relays. In addition to the revised instructions, the specifications of portable a-c. ammeters and portable a-c. voltmeters were submitted to supersede the previous specifications. The report further included instructions entitled Signal Maintenance, which has been prepared by the Committee to supersede Questions and Answers for Signal Maintainers, and Rules for Signal Maintenance. Chapter XXI—Hump Yard Systems, of the series on American Railway Signaling Principles and Practices, is also a part of the report.

The report of the Committee on Designs included 19 revised drawings with statements of the reasons for making the revisions, a list of the subject matter to be superseded, and a list of 9 obsolete drawings which are to be removed from the Manual. In addition, 12 new drawings were submitted. Revised specifications for gray iron castings, malleable iron castings and wrought iron bars refer to the corresponding standards of the American Society for Testing Materials. A revision of the specification for Signal Glasses with explanatory matter is also a part of the report.

The report of Committee VII included a revision of the form entitled Signal and Interlocking Unit Distribution with additions and revisions of the Table of Signal and Interlocking Units, and a general classification for signal interruptions. Also included in the report is a list of Principles Applicable to Joint Signal Facilities.

The report of the Committee on Alternating-Current Automatic Block Signaling included revised specifications low-voltage lightning arrester, and air-cooled transformer, and new specifications for electric color-position light signal, and capacitor for power-factor correction. As a part of the report, a paper entitled "Capacitors for Power-Factor Correction and Their Importance to Signal Systems," by R. B. Amsden of the Illinois Central, was read.

The report of Committee IX was composed of progress reports on (1) Steel, Bronze and Zinc-Taped Cables, (2) Specification for Copper-Covered Steel and Bronze Messenger and Guy-Strand Wires, and (3) Specification for Non-Metallic Underground Cable. In addition to the progress reports, two specifications, Weather-Proof Covering for Line Wire and Attaching Railroad Signal Wires, and Cables to Communication Pole Lines, were included, the latter specification having been revised in accordance with action taken at a joint meeting of representatives of the Signal Section and the Telegraph and Telephone Section.

The report of the Committee on Materials Research comprised a revision of the specification, Hard Fiber; a new specification, Brass and High Tensile-Strength Metals and Alloys for Binding Posts, Machine Screws, Nuts, Washers, etc., Used in Signal Apparatus; and a report of investigations relative to the use of exhausted caustic-soda battery solution as an anti-freeze liquid in railroad motor cars.

N. R. A. A. Presents Excellent Exhibit

W. Homer Hartz
President

Manufacturers of appliances employed in the construction and maintenance of fixed properties hold twenty-fourth supply show at Coliseum, after four-year interruption

C. W. Kelly
Secretary

SECOND only in importance to the two conventions held in Chicago this week, was the resumption by the National Railway Appliances Association of its annual exhibit, which has long been an important feature of "Engineering Week" in Chicago. These displays of materials and appliances used in the construction and maintenance of railway tracks, bridges, buildings and allied facilities attracted much attention from those attending the convention by reason of their proven educational value.

This is the first exhibit held since March, 1931, the action of the American Railway Engineering Association in restricting the programs of its conventions to two days in 1932, 1933 and 1934, compelling the N.R.A.A. to forego exhibits in those years. However, a skeleton organization was maintained during the inactive years, with the result that after the board of direction of the A.R.E.A. decided last March to hold a three-day convention this year, it was possible for the N.R.A.A. to proceed with plans for an exhibit. The exhibits presented by 91 supply companies occupied substantially all available space in the Coliseum's great central hall.

Decorations in the form of a cloth screen in blue and white that covered the entire barrel-vault ceiling and a polychrome treatment of the spandrels at the two ends of the room added greatly to the attractiveness of the exhibit as a whole. Especially noteworthy was the elaborate composite exhibit presented by the U. S. Steel Corporation subsidiaries, which occupied the equivalent of 20 individual exhibit booths. The major unit of this exhibit consisted of a replica of a concrete-encased steel-pile trestle supporting a gigantic tee-rail, surmounted by an artist's conception of the spirit of the high speed train. Occupying a conspicuous location in the center of the hall, this design gave a tone to the exhibit as a whole from which all participating companies benefitted.

Taken in its entirety, the show comprised an object-lesson in the advance made in equipment and appliances during the last four years. Improved track materials, and new materials or new applications of materials for use in structures had an important place among the products on display. Even more prominent were the many new and improved power tools, among which welding outfits and grinding machines of various kinds were especially prominent. However, the products on display covered almost the entire field of railway construction and maintenance.

The officers of the National Railway Appliances Association during the past year, who took the leadership in formulating plans for resuming the exhibit, were headed by W. Homer Hartz, president of the Morden Frog & Crossing Company. The other members of the executive committee include the vice-president, Thomas O'Leary, Jr., sales manager, transportation division, western district, Johns-Manville Sales Corporation, Chicago, and the following directors: C. H. White, district sales manager, Industrial Brownhoist Corp., Chicago; A. L. McNeill, manager railroad department, Okonite Company, Chicago; E. D. Cowlin, general sales manager, Eaton Manufacturing Co. (Reliance Spring Washer Div.), Massillon, Ohio; H. H. Talboys, manager of railway sales, Nordberg Manufacturing Company, Milwaukee, Wis.; L. B. Sherman, senior vice-president, *Railway Age*, Chicago; H. H. McDonald, representative, Lorain Steel Co., Chicago; honorary director, Alex. Chapman, district sales agent, Rail Joint Company, Chicago. Detailed arrangements for the exhibit were directed by C. W. Kelly, secretary of the association.

Annual Meeting

Some of the difficulties that confronted the board of directors of the N.R.A.A. in planning for the exhibition were reviewed by President Hartz at the annual meeting of the association on March 11. Owing to uncertainties, he said that it was impossible for the board to arrive at any definite decision until its meeting in June, 1934, but even then it was not until September that the board was in a position to instruct the secretary to prepare space contracts. He reported also that the board was in no way committed to the Coliseum as the place of exhibit and was willing to entertain suggestions concerning any other location that would fulfill the requirements as to allowable floor load, head room and accessibility. In closing, he expressed his appreciation of the co-operation that the N.R.A.A. had received from the American Railway Engineering Association in so scheduling its program as to afford ample time for its members to visit the exhibit.

The treasurer's report showed total anticipated revenues of $34,338 and a total outlay of about $31,170 after all expenses have been paid, which indicates a surplus of about $3,800 for the year's operations.

In the election of officers, Mr. O'Leary was advanced to the presidency, Mr. White became vice-president, Mr.

Kelly was re-elected secretary-treasurer, Mr. Talboys was re-elected director and C. M. Hoffman, vice-president, Dearborn Chemical Company was elected a director.

Following is a list of the exhibitors, giving the products exhibited and the names of their representatives:

List of Exhibitors

Adams & Westlake Co., Chicago; relays, signal lamps, switch lamps, lanterns; A. S. Anderson, E. Andrews, U. Hedin, R. D. John, C. H. Larson, D. F. McCarthy, W. J. Piersen, W. A. Smith and H. G. Turney.

Air Reduction Sales Co, Chicago; oxygen and acetylene, gas welding and cutting apparatus and supplies, literature, demonstration of heat-treating rail ends with 2-flame tip; C. B. Armstrong, J. F. Callahan, C. A. Daley, R. L. Galloway, C. D. W. Gibson, W. A. Handrock, H. A. Hocking, J. W. Kenefic, W. Ludington, R. T. Peabody, H. L. Rogers, E. M. Sexton, G. Van Alstyne, M. M. Weist and D. J. Williams.

American Car & Foundry Co., Chicago; automatic electric steel bar heater, electric rivet heater, electric metal heaters for heat treating; F. C. Cheston, H. C. Cheston and A. G. Wood.

American Fork & Hoe Co., (Shovel division), Cleveland, Ohio; shovels and scoops; H. C. Branahl, J. M. Burbank, G. L. McKewin, A. E. Milligan and Frank Reagan.

Austin-Western Road Machinery Co., Aurora, Ill.; model and moving picture of automatic air-dump car, literature on road machinery and power shovels; S. F. Beatty, Jr., J. D. Benbow, H. B. Bushnell, H. B. Cadmus, C. C. Chamberlain, J. E. Huber, H. M. Kleiser, Jes Mossgrove, C. S. Sencenbaugh and Bruce F. Smith.

Barco Manufacturing Co., Chicago; stove, gas hammers, tie tampers, flexible pipe joints; William Behlke, R. A. Donaldson, R. A. Duncan, Charles Janister and F. L. Miller.

Barrett Co., New York; tar, bituminous road materials and grade crossing materials, samples of prepared and built-up roofing, samples of creosote and protective paints; C. H. Olmstead and Harold E. Weeks.

Bethlehem Steel Co., Inc., Bethlehem, Pa.; positive control switch stand, hook-flanged guard rail, insulated and non-insulated gage rods and fittings, switch stands, complete switch, adjustable switch brace, forged steel car wheels, and axles; C. A. Alden, C. Cecil, R. P. Deghuee, R. O. Gillespie, John F. Hennessy, F. M. Huffman, O. W. Johnson, R. Knibloe, W. B. Lang, R. R. Miller, J. W. Murphy, George Riddle, Ed Runk, C. E. Simmons, J. W. Stoever, M. A. Vickers and A. A. Warg.

Binks Manufacturing Co., Chicago; paint spraying equipment, pictures of water cooling systems, literature on paint spraying; S. Bramsen, W. B. Crawford, F. G. Garrison, V. G. Green, G. A. Harker, B. J. Hedger, L. W. Horr, Neil C. Hurley, J. C. Johnson, E. W. Kinder, C. R. Kranz, J. F. Roche, F. L. Terrill, E. F. Watts and A. E. Wendt.

Caterpillar Tractor Co., Peoria, Ill.; talking motion pictures of caterpillar tractors; G. A. W. Bell, Jr.; H. E. Fisk, W. H. Gardner, L. E. Hosler and G. E. Spain.

Chicago Pneumatic Tool Co., New York; air compressors, electric and pneumatic tie tampers, electric frequency changers, portable, pneumatic and electric track tools and pneumatic and electric bridge tools; H. G. Barbee, C. B. Coats, S. A. Congdon, Jr., H. R. Duebel, L. F. Duffy, A. H. Gerald, F. J. Jobst, G. C. Vanden Boom, L. J. Walker.

Chipman Chemical Co., Inc., Bound Brook, N. J.; map of operations, chemical weed killer; J. K. Aiman, R. N. Chipman, N. J. Leavitt and I. J. Strain.

Cleveland Frog & Crossing Co., Cleveland, Ohio; switches, frogs, crossings, switch stands, switch accessories; J. A. Donahey, E. W. Goodaire, L. G. Parker, G. A. Prendergrast and J. I. Prentice.

Cleveland Tractor Co., Cleveland, Ohio; track-type tractors, front-end loader, welding equipment, and air compressors; H. B. Cadmus, W. E. Miles, D. A. Milligan, J. W. Montigney and Jess Mosgrove.

Conley Frog & Switch Co., Memphis, Tenn.; models of expansion joints, turntable joints and self-guarded manganese spring frogs; E. H. Baumgarten, John C. Conley, J. E. Conley, F. G. Dunbar.

Crerar Adams & Co., Chicago; rust preventive, fire extinguishers, hydraulic lift, track jacks, track and bonding drills, pipe pushers, demolition tools; pipe bender, knockout punches, pipe and machinist wrenches; George J. Doyle, Robert Ferguson, Adolph Hawkinson, E. C. Poehler, Irving Poehler, Paul Rabe, Fred Rix, J. M. Temple, T. F. Tough and Russell Wallace.

Dearborn Chemical Co., Chicago; water treating equipment, pumps, chemicals, rust preventives, water testing equipment, chemical proportioning pump; E. M. Converse, Jos. Cremer, E. A. Goodnow, C. M. Hoffman, F. B. Horstman, S. C. Johnson, R. Q. Milnes, A. Moeller and C. C. Rausch.

De Sanno & Son, A. P. Inc., Philadelphia, Pa.; abrasive wheels and abrasive cutting machine, literature; L. E. Buckingham, R. A. Burton, B. G. Hardy, S. M. Hershey and J. C. Rinehart.

De Vilbiss Company, Toledo, Ohio; paint spray guns, rubber hose, air compressors, literature; Geo. R. Cooke, R. A. Guyer and J. W. Savage.

Paul Dickinson, Inc., Chicago; smoke jacks, chimneys for small buildings, roof and deck drains, roof ventilators (full size and models); A. J. Filkins.

Eaton Manufacturing Company, (Reliance Spring Washer Div.) Massillon, Ohio; spring washers; E. D. Cowlin, E. C. Gross, E. J. Helline, H. J. McGinn, R. L. Shireman and A. H. Weston.

Electric Storage Battery Co., Philadelphia, Pa.; storage batteries, two-rate-charger, control relays and exide float meters; A. H. Adkins, G. H. Atkin, R. I. Baird, E. Bishop, G. V. Cripps, C. Daunt, W. E. Dunn, J. D. Fischer, H. S. C. Folk, K. W. Green, R. Jardine, F. T. Kalas, E. F. Kleist, E. Kline, W. R. Knappenberger, E. L. Lord, C. B. McCormick, R. O. Miles, T. Milton, W. H. Payne and M. W. Turner.

Electric Tamper & Equipment Co., Ludington, Mich.; concrete electric vibrator, hammer blow electric tamper, electric vibrator tampers, tooth-tip tamper blades, electric generator sets, literature; G. E. Cartier, H. W. Cutshall, J. F. Hensel and G. L. Walters.

Evans Products Co., Detroit, Mich.; grade crossing protection, rail-highway truck, motion pictures; E. S. Evans, J. M. Evans, D. W. Main, O. G. Moore, F. L. Seeley and Era Summar.

Fox Hi-Speed Grinders, Pittsburgh, Pa.; rail grinders; Clark O. Allen, A. W. Collins and H. A. Schwartz.

Gardner-Denver Company, Quincy, Ill.; railway type and stationary air compressors, tie tamper; H. O. Dwight, Dan Higgins, C. E. Kaiser, L. Loewe, R. H. Pearson and R. F. Watson.

Harnischfeger Corp., Milwaukee, Wis.; arc welders, electric hoists, motion pictures of crawler cranes and shovels, electric motors, carbon-arc torch; G. L. Drake, J. O. Ferch, Roy R. Heding, D. B. Patterson and R. J. Wadd.

Hollup Corp., Chicago; gas-driven electric welding outfits, welding hand shields and helmets, motor-driven 300-amp. arc welding set, welding rods, literature; R. C. Barr, Ray Bender, A. Bernard, R. A. Davidson, O. L. Howland, R. B. Monroe, J. Muller, W. S. Palmer, W. C. Pearson and Geo. Rohder.

Industrial Brownhoist Corp., Cleveland, Ohio; literature on power-equipment; S. F. Eble, Hoyt Hayes, A. P. Lyvers, Melvin Pattison and C. H. White.

Ingersoll-Rand Company, New York; crawler-mounted compressor—8 tool, railway-mounted compressor—4 tool, railway-mounted oil engine compressor—16 tool, other compressors of various capacities, tie tampers, pneumatic tools, rock drills and mining tools, bridge and building tools; W. H. Armstrong, G. E. Bridge, G. A. Gallinger, L. A. Luther, F. J. McDonough, George W. Morrow, A. Ringer, T. H. Weigand and D. W. Zimmerman.

Ingot Iron Railway Products Co., Middletown, Ohio; corrugated metal culverts, paved-invert culvert pipe, standard and helical perforated pipe, multi-plate culvert pipe, metal cribbing, corrugated tunnel liner plates, automatic drainage gate, spiral welded pipe; E. C. Campbell, C. M. Colvin, E. T. Cross, W. N. Crout, W. R. Fraser, W. P. Greenawalt, S. R. Ives, Wm. Kelly, N. A. Powell, A. W. Spaulding, W. H. Spindler, J. R. Wilks and J. L. Young.

Inland Steel Company, Chicago; literature on rail, track accessors, floor plate bars, shapes, plates; J. De N. Macomb, G. W. Nibbe, C. R. Robinson and H. R. Vielehr.

International Harvester Co. of America, Chicago; Diesel power unit, two gasoline power units, small track-type tractor with generator, crane-equipped tractor, tractor with power shovel, street sweeper, display model of Diesel injection; L. B. Birckhead, F. Bonnes, L. B. Buchanan, Lee Clark, C. E. Dahlgren, L. E. Dauer, R. C. Flodin, A. R. Hance, W. F. Hebard, William Hensel, Blake E. Hooper, F. G. Hough, Blake C. Howard, L. B. Johnson, W. M. Parrish, H. C. Sage, William Salem, H. P. Thieman, A. W. Turner and F. O. Wyse.

Johns-Manville Corp., New York; transite conduit, roofing, transite pipe, transite smoke jack, asphalt mineral-surface bridge plank, full line of fireproof building materials, insulation, friction materials, refractory cements; P. R. Austin, C. E. Bryant, W. R. Bush, Carl S. Clingman, E. L. Colopy, A. F. Eichhorn, E. Fairback, H. Flannagan, W. J. Hennessy, H. D. Hitchcock, J. D. Johnson, R. J. Offutt, Thomas O'Leary, Jr., W. B. O'Neill, L. Papineau, C. M. Patten, A. C. Pickett, H. R. Poulson, W. W. Prosser, W. J. Stewart, R. P. Townsend, John H. Trent and E. H. Wells.

Jones & Laughlin Steel Corp., Pittsburgh, Pa.; working model of a blooming mill; R. H. Atwood, M. A. Blessing, G. C. Congdon, C. E. Conley, A. G. Hoover, I. H. Mlodoch, B. J. Irwin, H. J. Watt and F. F. Vowinkle.

O. F. Jordan Co., East Chicago, Ind.; model of Jordan

spreader and moving pictures; A. W. Banton, J. C. Forbes, W. E. Kasten, H. M. McFarlane and Walter J. Riley.

Kerite Insulated Wire & Cable Co., Inc., New York; insulated wire and cables; E. L. Adams, E. M. Branchfield, C. M. Deardorff, W. H. Fenley, J. A. Hamilton, H. J. Harrel, C. A. Reeb, A. H. Smith and J. W. Young.

Le Carbone Company, Boonton, N. J.; Primary batteries, carbon products; W. Bechtel, R. Boley, E. C. Brehm, W. R. Catching, M. J. Fox, H. R. Partridge, P. G. Pendorf and P. R. Roberts.

Lehon Company, Chicago; prepared roofing, asphalt shingles, asbestos shingles and roof coatings; S. Campagna, John Eipper, Edward Mayhew, John W. Shoop and H. A. Wolfe.

Albert H. Letterman (successor to Mechanical Mfg. Co.), Chicago; bumping post; George Dolan, C. H. Gutmacher and E. A. Schlamp.

Lewis Bolt & Nut Co., Minneapolis, Minn.; sheathing bolts, timber bolts, guard-rail bolts; T. F. Clifford, R. B. Hill, T. E. Murphy, G. A. Prendergast and Fred T. Robertson.

Locomotive Finished Material Co., Atchison, Kan.; alloy steel self-guarded frog, model of cast iron crossing, adjustable rail brace, adjustable guard-rail block; R. L. McIntosh, A. H. Moorhead, H. E. Muchnic and G. W. Taylor.

Lundie Engineering Corp., New York; tie plates, rail and flange lubricator; E. Brandeis, L. V. Armstrong, C. E. Irwin and Charles Stone.

MacRae's Blue Book Co., Chicago; copy of publication; F. J. Canavan, W. P. Dent, B. E. Haynes, J. H. Hibbard, C. Hill, R. S. Jaquith, J. W. Palmer, S. M. Prazak, F. O. Rice, J. H. Robinson, W. B. Sheehan, S. Simonson, R. C. Taylor and C. S. Wallace.

Magnetic Signal Company, Los Angeles, Cal.; highway crossing signal, illuminated stop sign for crossing signal, portable sanitary drinking fountain; Laurance Boswell, D. F. Hilton, R. W. Payne, H. W. Renick and J. V. Wescott.

Maintenance Equipment Co., Chicago; rail and flange lubricator, switch-point protector, blue-flag derail, model of friction car stop, picture of three-man rail layers, samples of graphite base lubricants; D. M. Clarke, A. J. Frystak, E. Overmier, T. E. Rodman and R. J. Shanahan.

Mall Tool Co., Chicago; 3 hp. gasoline concrete vibrator; 5 hp. gasoline rail grinder, cross slotting attachment, 3 hp. electric rail grinder, nut setting attachment, portable saw, 1 hp. sheet grinder for shop use; Merle Elrick, Charles Frame, William Garbouch, H. W. Gaston, J. W. Innes, F. E. Kilbourn, Mr. Long, A. W. Mall, F. McGonigle, F. Mortensen, M. Rehnquist, William Sanders, R. Schwass and Mr. Walzak.

Maloney Oil & Manufacturing Co., New York; Asphaltic Materials Company, Inc., Chicago; bituminous highway crossings, station platforms, parking areas, waterproofing mastics, protective coatings; W. R. Collins, F. X. Kern, M. W. Lefever and W. T. Reece.

Massey Concrete Products Corp., Chicago; concrete crossing slabs, literature on pipe and other concrete products; E. C. Alexander, Ross Clarke, Charles Gilman, E. M. Hatheway, J. A. Higgs, J. A. Hobson, D. A. Hultgren, C. H. Hunsaker, J. W. Lowell, W. L. McDaniel, G. H. Redding, W. H. Robertson, G. H. Wade and H. W. Wilder.

Metal & Thermit Corp., New York; Pressure welding equipment for rail joints; Anton Lucas, John B. Tinnon, H. T. Thompson. L. G. Vock, C. D. Young.

Morden Frog & Crossing Works, Chicago; manganese insert frog, spring rail frog, taper rail, compromise joints, guard rail, adjustable rail brace, foot guard, reflex switch lamp, switch accessories; E. C. Argust, R. A. Brown, W. Homer Hartz, J. F. Karcher, G. F. Killmer, Lyle Martin, C. E. Murphy and Samuel S. Withrow.

Morrison Railway Supply Corp., Buffalo, N. Y.; osmose wood preservative, grinding wheels, oil burning pre-heater, welding rods, switch point guard, literature on welding service; E. Bostrum, G. J. Diver, M. B. Morrison, R. L. Morrison and E. Smith.

National Carbide Sales Corp., New York; acetylene light and lantern, carbide; E. C. Ackerman and F. E. Mull.

National Carbon Company, Inc., New York; dry cell batteries, flashlight cells, flashlight cases, high-voltage signal cells, anti-freeze and anti-rust compounds, air-cell batteries, carbon brushes, and carbon rods; A. S. Callaway, Ernest Cordeal, J. S. Gemmell, D. H. Green, R. L. Hasbrook, F. C. Henderson, M. D. Rees, A. C. Scott and William Julian.

National Lead Co., New York; red lead, white lead, linseed oil, liquid dryer, lead mixing oil, colors in oil, expansion bolt, J. O. W. Belt, F. M. Hartley, Jr., F. W. Maynard, O. Meyer and A. H. Sabin.

National Lock Washer Co., Newark, N. J.; spring washers, ferrule wedge for tool handles; F. B. Archibald, George Goodell, W. R. Hillary, G. LaRue Masters, A. W. Preikschat, W. H. Reaves and Stanley H. Smith.

Geo. P. Nichols & Bro., Chicago; model of transfer table, duplex control for three-power turntable, roller-bearing wheel unit, and roller-bearing assembly for turntable trucks; B. Goldman and S. F. Nichols.

Nordberg Manufacturing Co., Milwaukee, Wis.; surface grinder, utility grinder and accessories, lag screw driver, track drill, adzing machine, power jack, spike puller, power track wrench; C. P. Clemmens, W. W. Fitzpatrick, A. C. Harrison, C. K. Jensch and H. H. Talboys.

Okonite Company, Passaic, N. J.; insulated wires and cables, friction tape rubber splicing compound; R. N. Baker, A. L. McNeill, E. H. McNeill, J. J. O'Brien, W. R. Van Steenburgh and F. J. White.

Oxweld Railroad Service Co., Chicago; welding equipment, samples of welded rail, switch points and pipe, compromise joints, samples of Stillite in track equipment, flood lights, moving pictures of welding operations; Lem Adams, M. C. Beymer, G. P. Bogert, S. S. Corfman, W. E. Donalds, F. J. Duffie, A. F. Garberding, C. J. Gavin, F. G. Gigandet, F. C. Hasse, W. A. Hogan, P. Hunter, Jr., H. W. Kofmehl, William Leighton, A. McCawley, G. B. Moynahan, D. H. Pittman, E. S. Richardson, J. H. Rodger, L. C. Ryan, H. W. Schulze, J. C. Stephenson, J. G. Tawse, F. C. Teichen and J. E. Winslow.

Pettibone Mulliken Company, Chicago; high and low switch stands, safety spring stand, mechanical switchman, gage rod and switch-point lock; C. A. Johnson, C. Lambert, George Lyman and G. J. Slibeck.

Pocket List of Railroad Officials, New York; copies of publication; J. Alexander Brown, Harold A. Brown and B. J. Wilson.

Pomona Pump Co., Pomona, Cal.; deep-well turbine pump; H. B. Barton, G. W. Clucas, C. C. Cook, R. J. Ernst, H. W. Ross and J. M. Stannard.

Q & C Co., New York; tie plate and rail fastener, switch-point guard, derail, gaging tool, gage rods, rolled steel compromise joints, alloy steel compromise joints, guard rail clamp, safety rail tongs; G. H. Goodell, L. E. Hassman, F. H. Kemper, F. F. Kister, J. L. Terry and Lewis Thomas.

Rail Joint Company, New York; standard and insulated joints, controlled or intermittent bearing joint, armored insulated joint, alloy compromised joint. Alex Chapman, E. A. Condit, C. B. Griffin, H. C. Hickey, G. H. Larson, J. N. Meade and E. F. Schermerhorn.

Railroad Accessories Corp., New York; power track machines for tightening and loosening nuts and setting screw spikes, moving pictures of track machines in use; S. G. Ellis, F. C. Lavarack, B. A. Lundy and F. F. Seeburger.

Railway Age, New York; copies of publication; G. E. Boyd, M. H. Dick, John Dunn, F. J. Fischer, O. C. French, S. W. Hickey, Elmer T. Howson, F. C. Koch, W. S. Lacher, J. G. Little, H. E. McCandless, H. H. Melville, H. A. Morrison, L. B. Sherman and C. J. Wageman.

Railway Maintenance Corp., Pittsburgh, Pa.; moving picture of ballast-cleaning mole; John F. Casey, John F. Casey, Jr., C. E. Lott, J. B. McWilliams.

Railway Purchases and Stores, Chicago; copies of publication; J. P. Murphy, Jr., and K. F. Sheeran.

Railway Track-Work Co., Philadelphia, Pa.; portable reciprocating track grinder, portable stock-rail grinder, electric track grinder, rail-joint cross grinder, portable track grinder, samples of abrasives, literature; A. M. Nardini and H. J. Perazzoli.

Ramapo Ajax Corporation, New York; Racor Pacific Frog & Switch Co., Los Angeles, Cal.; metal highway crossing, reversible manganese steel railroad crossing safety switch stands, rigid switch stand, spring stands, switch points, guard-rail clamps, limit gages (frog and crossing), adjustable and standard rail braces, vertical compensating switch rods, switch clips, gage rods; T. E. Akers, W. Bender, G. A. Carlson, G. M. Cooper, J. E. Davidson, R. E. Einstein, D. Fairback, W. J. Fairback, D. F. Hilton, P. Hoffman, A. F. Huber, J. S. Hutchins, R. W. Payne, W. A. Peddle, W. Perdue, H. W. Renick and J. B. Strong.

S. E. Rawls Company, Streator, Ill.; track mower, motor scythe; C. F. Butts, H. A. Fedman, E. J. Jaeger, Mertz Rawls and S. E. Rawls.

Republic Steel Corp., Youngstown, Ohio; track accessories, steel fence post, metal culverts, wire, guard rails, steel sheets, steel pipe and fittings, electric conduits, steel lockers and shelving, high tensile steel, stainless steel products; C. H. Aiken, H. D. Burdick, E. K. Connely, C. H. Ellison, W. T. O'Neill, A. J. Roof, C. W. Ruth and L. L. Solger

Ross and White Co, Chicago; operating model of a motor-driven heliocentric coaling-plant hoist, photographs of coaling and cinder plants, and literature; Glen O. Morford, Clyde P. Ross and David E. White.

Sellers Manufacturing Co., Chicago; wrought iron tie plate, angle bars rolled from steel axles; J. T. Flynn, W. L. Helliwell, G. M. Hogan, A. F. McCoole, R. J. Platt, S. H. Smith and R. A. Van Houten.

Speno Railroad Ballast Cleaning Co., Hoboken, N. J.; moving pictures of ballast-cleaning operations; Frank Speno and Frank Speno, Jr.

Sperry Products, Inc., New York; (Rail Service division);

transverse fissured rails found in track by Sperry detector car, Gyro portable track recorder; W. A. Damerel, J. A. Drain, Jr., H. C. Drake, J. B. Farwell, C. W. Gennet, Jr., and A. Stewart.

Standard Equipments, Inc., Boston, Mass.; rail joint bar assembly; instrument to measure end wear and batter, and fishing height wear; E. W. Backes, C. O. Bradshaw, A. E. Hill, J. E. Hoving, E. F. Oviatt.

Syntron Company, Pittsburgh, Pa.; electric tie-tamper outfits, electric concrete vibrators, electric screw spike drivers, tie borers, saws, scaling hammers and dry chemical feeder; D. G. Black, J. F. Chandler, N. C. McKelvey, H. S. Paul and J. A. Roche.

Teleweld, Inc., Chicago; joint shim, samples of welded joints, heat-treated joints, Brinnel-hardness tester, electric welding rod; T. L. Borman, G. A. Greene, C. W. McKee, H. E. McKee, W. A. Peck, Stanley H. Smith and A. M. Wood.

United States Steel Corporation Subsidiaries:

American Bridge Co., Pittsburgh, Pa.; views of bridge and building projects, section of steel cable to be used on San Francisco Bay bridge; Edward Capouch, Newton O. Holt, Elmo V. Smith and Walter G. Zimmermann.

American Sheet & Tin Plate Co., Pittsburgh, Pa.; stainless steel structural sheets, high tensile steels, car-roofing structural shapes, corrugated metal culvert pipe; C. H. Altenhof, W. P. Andrews, H. T. Bennett, T. Fitzgerald, Jr., D. T. Haddock, R. F. Johnston, G. N. Schramm and F. L. Trump.

American Steel & Wire Co., Chicago; railroad wire fence, steel posts, gates, signal bonds, signal wire, parkway cable, Fiege fittings, wire for miscellaneous purposes; H. R. Barthell, H. H. Bullen, C. A. Cochrane, F. J. Conkling, W. H. Cordees, H. H. Febrey, M. W. Floto, W. M. Floto, A. W. Froude, E. E. Lewis, D. A. Merriman, J. W. Patterson, L. P. Shanahan, H. A. Squibbs, H. D. Worthington, C. F. Wyley.

Carnegie Steel Co., Pittsburgh, Pa.; steel bearing piles, steel sheet piling, combination steel and concrete crossing, section of locomotive frame flame-cut from rolled billet; J. C. Dilworth, Albert M. Harper, H. G. Marsh and John A. Reed.

Cyclone Fence Co., Waukegan, Ill.; chain-link fencing, iron picket fence, wire partition screens; S. W. Burr, F. E. Kyndberg, C. W. Pankey and W. K. Sandmeyer.

Illinois Steel Co., Chicago; steel car wheels, tie plates, screw spikes, bolts, nuts, floor plate, steel sheet piling and steel bearing piles; O. H. Baker, John Brunner, F. S. Crane, J. F. Dame, J. J. Davis, C. B. Friday, Robert G. Glass, S. L. Graham, N. M. Hench, John Hornbrook, Grant Monk, C. R. Moffatt, G. A. Price, T. H. Sanderson, A. H. Warren, Jr., and L. B. Worthington.

National Tube Co., Pittsburgh, Pa.; duroline pipe, lap-weld and butt-weld standard steel pipe, seamless boiler tubes, hot and cold finished seamless tubing, 18-8 stainless steel and heat resisting pipe and tubes, signal pipe; T. W. Gamble, J. J. Kennedy II, J. S. Raymond, B. H. Rickard and W. L. Schaeffer.

Lorain Steel Co., Johnstown, Pa.; GEO turnout; T. W. Brush, Carroll Burton, H. H. McDonald, J. A. McHugh, R. B. Porter, M. L. Rahner, D. P. Steward, H. C. Stiff.

Scully Steel Products Co., St. Louis, Mo.; nothing on exhibition; Frank B. Dawson, George Mason, Jr., George B. McConnell, A. S. McEldowney, A. Nelson, Walter Schuett, L. H. Schwan, Andrew Verschuur.

Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.; nothing on exhibit; G. C. Brunner and Y. P. Lewis.

Universal-Atlas Cement Co., Chicago; concrete fence; A. C. Cronkrite, E. J. Dowdall, E. R. Gustafson, F. E. Guy, O. H. D. Rohwer, F. L. Stone and C. A. Webb.

U. S. Wind Engine & Pump Co., Batavia, Ill.; water-column valves, switch stands, semaphore switch stands, float valves, models of water tanks and towers; H. Beem, R. C. Carlson, J. P. Prindle, E. Schumacher, Le B. Turner and C. E. Ward.

Western Railroad Supply Co., Chicago; flashing-light crossing signals, wigwag signals, revolving-banner signals, crossing bells, semaphore lamps, gate lamps, switch lamps, motor car spotlight, reflectorized signs, lightning arresters, anunciators, electric meters, signal accessories; H. M. Buck, Theodore H. Cole, W. Dinnerville, L. V. Dolan, S. M. Dolan, J. C. Duranceau, C. G. Elliott, Frank Faeth, Godfrey Gort, John Hensel, F. M. Hill, Harold Jones, J. N. Meade, S. Miskelly and Stanley H. Smith.

Wilkening Manufacturing Co., Philadelphia, Pa.; piston rings for motor cars, work equipment, pumps and stokers; A. J. Weigand.

Wilson Grade Crossing Safety Device, Washington, D. C.; highway grade crossing protection; Mercer D. Wilson.

Youngstown Sheet & Tube Co., Youngstown, Ohio; model of spike-making machine, model of butt-weld pipe mill, tie plates, transparencies showing steel-making operations; H. R. Barrett, Harry Bascom, H. W. Broecker, J. H. Clark, W. H. Carhart, O. A. Elliott, E. E. Erven, M. G. Henderson, C. C. Kempert, John M. Mulholland, L. F. Newton, V. Sanden, William Texter, A. Vogt and G. Wagstaff.

Pension Law Case In Supreme Court

(*Continued from page 388*)

general social legislation not within powers delegated by the Constitution and the guise of the commerce power is a mere pretext.

The second main division shows that the act is unconstitutional because it extends its provisions to all employees of carriers, including those not engaged in interstate commerce, those engaged exclusively in intrastate commerce, and those not engaged in commerce at all. It thus violates the well settled rule of *The Employers' Liability Cases, 207 U. S. 463.*

The third division of the brief shows that the act is unconstitutional because it grants pensions for services rendered prior to its enactment. At the instant of the approval of the act all past service of employees of all carriers for thirty years back was revitalized and became the basis of enormous bounties. The annuities for such prior service payable in 1935 alone amount to $68,749,000. They will steadily increase in succeeding years until 1953 when the portion of the aggregate of annuities payable in that year, based solely on service performed prior to the enactment of the act, will amount to $137,435,000. On petitioners' own estimates, annuities to be paid employees for services performed prior to the enactment of the statute will aggregate $4,415,000,000, two-thirds of which is $2,943,000,000 and the present worth of this amount is $1,720,000,000. The authorities show that the act, by reason of this prior service obligation, is unconstitutional, exceeds the power of Congress, and violates the Fifth Amendment.

The fourth division of the brief shows that the act is unconstitutional in that it unlawfully undertakes to mingle and pool the resources and obligations of the carriers among themselves and with others. The act treats all carriers together as one employer and all employees of all carriers as the employees of one employer. It bases the pensions upon the wages and length of service in all accumulated employment of each employee with any and all carriers. It pools the obligations and resources of each carrier with all others.

Upon 56 of the respondents who have no employees 70 years of age or over, the act imposes a burden of $33,000,000 for pensions to 70-year old employees of other carriers. The act imposes the obligations of insolvent carriers upon those which are solvent and the obligations of abandoned carriers upon those which remain in existence.

The fifth division of the brief demonstrates that the concept of "a national transportation system" written into the law by transportation act, 1920, and the decisions by this court under that act, are no support for the retirement act. None of the provisions of transportation act, 1920, undertakes, as does this act, to make carriers partners in business or to destroy the separate corporate entity of the carriers or to take the property of one carrier and give it to another.

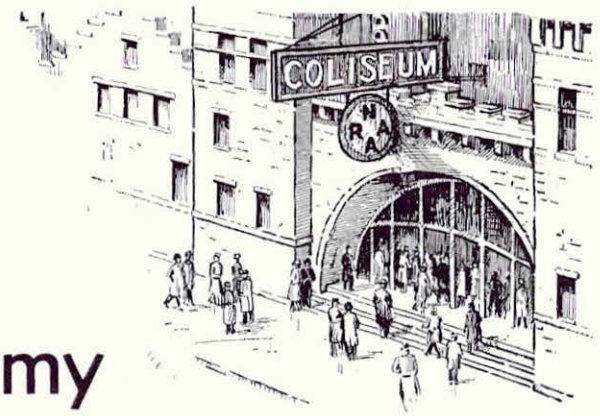
In the sixth division of the brief there are brought together in a group the various arbitrary, unreasonable, capricious and oppressive features of the act which bring it into conflict with the due process clause of the Fifth Amendment.

(1) The act violates the Fifth Amendment in requiring payment of pensions even to those who are not in railroad service at all. The various classes of those who are not employees of railroads but who come within the benefits of the act are pointed out. Their inclusion not only could have no reasonable relation to efficiency and safety in interstate transportation, but also violates the Fifth Amendment.

(2) Seven particular arbitrary features of the act are analyzed.

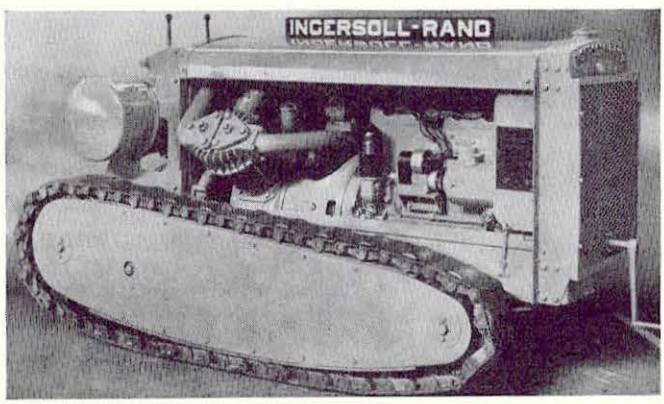
(3) The act is unreasonable and void because of the unconscionable cost imposed by it upon the railroads which are already in serious financial condition. The cost begins with $60,000,000 a year and increases year by year. In the tenth year it will aggregate $137,000,000. For prior service alone the cost will aggregate $2,943,966,000. This gives some idea of the still vaster sums which will be imposed on account of future service periods of present employees and of future employees. The act threatens the credit and the continued existence of the railroads.

Manufacturers Offer New Aids to Efficiency and Economy



I-R Develops Crawler Compressor

A SELF-PROPELLED tie-tamper compressor of the creeper type, which is known as the Crawl-Air compressor, has been developed by the Ingersoll-Rand Company, New York. This unit is 3 ft. 6 in. wide and 8 ft. 8 in. long and may be operated between the rails or along the shoulder of the track, no cribs being necessary. The hose lines leading to the tools can be connected directly to the manifold of the machine



The Ingersoll-Rand Crawl-Air Compressor

and pulled along, thus eliminating the need for long pipe lines.

It is said that the Crawl-Air compressor will climb grades up to 40 per cent and that, having a low center of gravity, it will not tip over on an incline of 45 deg. The machine can be loaded under its own power on hand cars for transportation over bridges, etc., and onto flat cars for longer hauls.

Each crawler of the compressor is powered by an independent air-motor drive, which feature is said to give easy and safe control when maneuvering. The air-motors allow operation in either direction and, it is said, permit the machine to be turned around on its own axis. They are also said to afford ideal brakes that prevent the machine from running away on steep grades, even with the engine stopped.

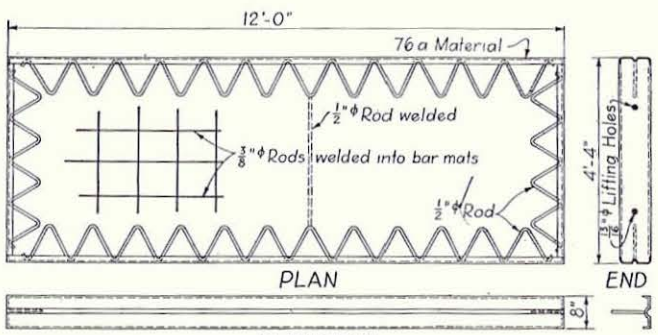
This unit has a two-stage, air-cooled, air compressor with a piston displacement of 125 cu. ft. per min. which delivers sufficient air to operate eight MT3 tie tampers. Power is furnished by either a gasoline or oil engine. When the unit is gasoline-driven, a Waukesha engine is used and when oil-engine driven an I-R Type H engine is employed. The latter engine has been developed especially for portable compressor service and is said to operate on a wide range of low cost fuels. It is claimed that the use of the oil engine results in savings in fuel costs up to 65 per cent.

In addition to tie tamping, the Crawl-Air compressor may be used for the operation of other pneumatic tools used in track and bridge and building work and also for operating sand blasts, paint sprays, rail drills, etc. The machine weighs 5,500 lb.

Truscon Improves Weltrus Crossing Slabs

RECENT developments in highway traffic are causing as much abuse to inter-track pavement at grade crossings on multiple track lines as to that within the track, for which reason the Truscon Steel Company, Youngstown, Ohio, has improved the design of its Weltrus reinforced inter-track slabs to include armor protection. The armoring is an adaptation of that applied to Weltrus crossing sections, having a ½ in. bar bent and welded to the side section. End plates are the same as those for the side section, so that the assembly forms a steel frame securely welded at the corners. To add stiffness to the frame, the reinforcing bars are welded at the corners where they come into contact with each other.

Depending on the length of the unit, one or two transverse reinforcing bars are welded to the side plates to eliminate possibility of bulging as the frame is being filled with concrete. These frames are furnished with two electrically-welded bar mats made of ⅜ in. rods. To fill a section, it is only necessary to lay the bar mat



Truscon Inter-Track Slab

on a smooth surface, set the frame over the top of the bar mat and wire it to the side members and to the reinforcing bar across the center of the section, 2 in. from the floor, then deposit concrete. The second bar mat is then placed in the frame in the same manner, but 2 in. from the top, and the concreting is completed.

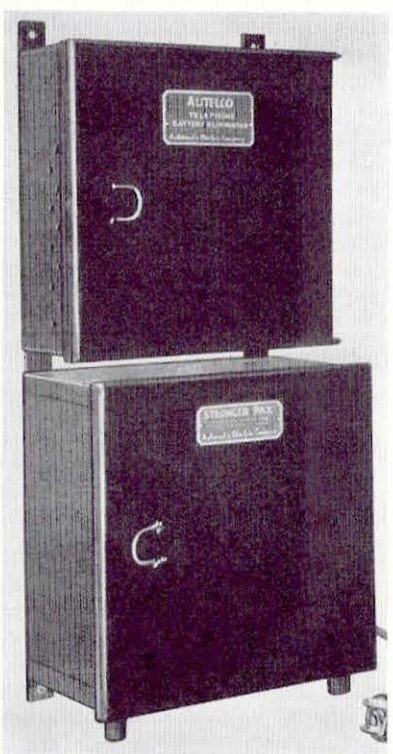
Lengths and widths of the slabs are varied to suit the conditions at individual crossings, and the thickness may be either 6, 7, or 8 in. The individual units can be provided with straight, beveled or skewed ends as required. One advantage claimed for this type of construction is that slab forms are unnecessary since the steel frame acts as a form, while the concrete is completely protected at the sides, ends and corners with armor which extends over onto the wearing surface.

Automatic Telephone System

A NEW type of private automatic interior telephone system, of 10-line capacity and simple design, has recently been placed on the market by the Automatic Electric Company, Chicago. It is known as the Type-34A16 P-A-X (Private Automatic Exchange).

Simplicity of installation is one of the principal features of this new system. The automatic switchboard incorporates a battery eliminator, which permits plugging into any 110-volt, 60-cycle outlet for power supply, the switchboard and eliminator being mounted together as a unit. When used in this way, no batteries of any sort are needed. Where 110-volt, 60-cycle current is not available, a second model, utilizing dry cells instead of a battery eliminator, may be employed. Both wall and desk handset telephones are available for use with this system, each requiring three connecting wires to the automatic switchboard.

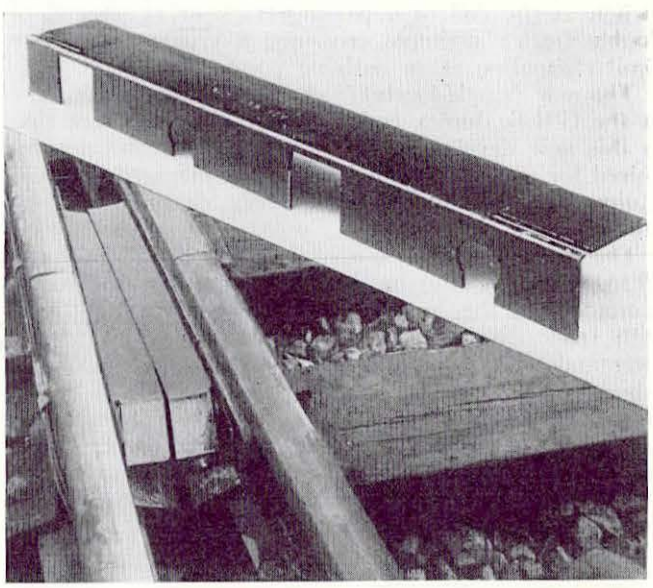
In spite of its small capacity, this system is said to have practically all of the advantages of the larger automatic systems put out by the Automatic Electric Company, including speedy dependable connections and secret service. Each telephone incorporates a standard 10-hole calling dial for setting up connections. After selection of the desired telephone in the usual way, the telephone is signaled by giving the dial an extra turn.



The Automatic Switchboard and Power Unit

Safety Foot Guard

A NEW adjustable device for guarding the joints at the heel and toe of frogs and at the heel of switches, has been placed on the market under the trade name of the Morden Universal foot guard, by the Morden Frog and Crossing Works, Chicago. The device consists of a ⅛ in. rolled steel plate bent to the proper shape, one leg being slotted to fit over the nuts on two of the bolts in the joint and under the heads of the other two. To install, all that is necessary is to place two wood blocks between the rails, loosen two bolts in each joint and slide the guard between the head of the bolts and the face of the joint bar, so that the oval necks of the bolts will engage the special shaped slots in the guard. The bolts are then tightened and one or both ends of the upper leg of the guard is hammered down over the end of the wood block, which may have either a square or a beveled end.



Morden Universal Foot Guard

A Double-Purpose Mixing Oil for Lead Paint

A NEW development in vehicles for white-lead paints is announced by the National Lead Company, New York. This product, which bears the label Dutch Boy Lead Mixing Oil, is a double-purpose vehicle which can be used for all white-lead paints except where a full-gloss finish is desired. It is particularly adapted for painting interior walls of plaster or wallboard, since it brushes easily, levels off and leaves no brush marks. It is said that it is washable and durable.

It is claimed that when this oil is mixed with white

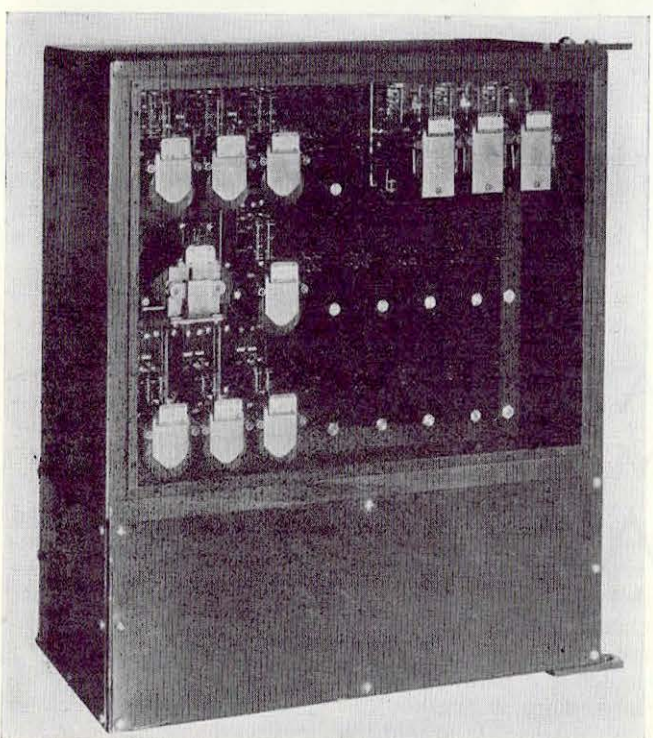
lead it has unusual sealing qualities, for which reason it is especially effective in sealing the pores and waterproofing stucco, concrete, brick, plaster and other similar surfaces, either in or outdoors. It is also said that when used, the paint is easy to mix and tint to conform to the desired color scheme, that it has large covering capacity and that it wears down slowly, leaving an excellent repainting surface.

Remote Control System

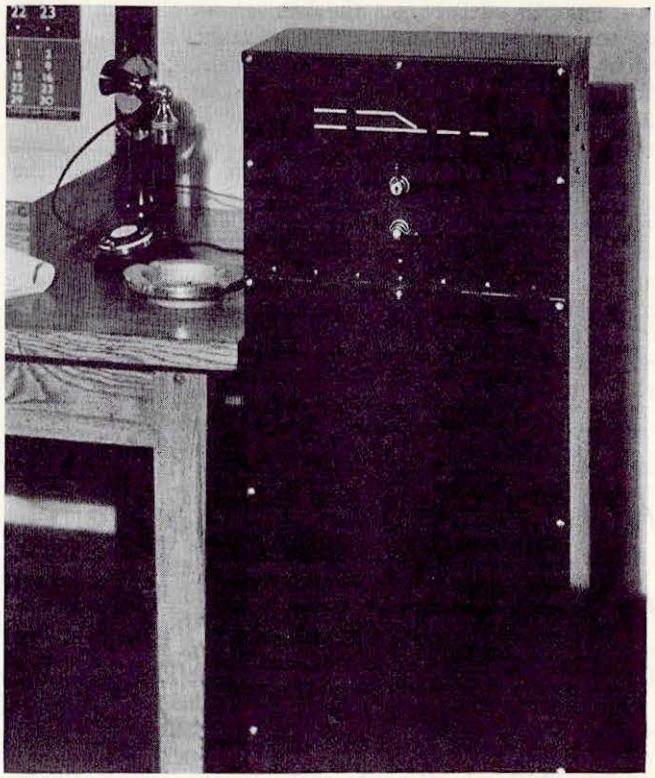
A CODED remote control system designed especially for a single location, such as an outlying switch and attendant signals, has been placed on the market by the General Railway Signal Company. This equipment provides a maximum of four controls and seven indications with three line wires, and can, therefore, be used for the control of such layouts as a switch at the end of a passing track or at an end of double track; a simple crossing; a crossover, or any similar situation at an outlying point.

The new "single-location" system is basically the same as the G.R.S. duplex coded C.T.C. system, except that in this new development the parts and circuits not required for a single layout have been eliminated, and the equipment is arranged in a newly designed line of cabinets.

The control-office unit, a steel cabinet 3 ft. 6 in. high, 15 in. wide and 10½ in. deep, contains all of the coded equipment at the control office. The operating panel, with track diagram, track lights, signal lever, switch lever and starting button, is mounted at the top of the cabinet within easy reach of an operator seated at his desk. At the top, rear, is a small switchboard panel containing two rheostats for adjustment of line currents, two ammeter jacks and a switch. Below the switchboard is a glass panel through which the operation of the relays can be easily observed. Exterior connections to line and battery are made at a terminal board in the base of the cabinet.



The Field Unit Consists of Coding Equipment in an Enclosed Case



The Office Unit Can Be Placed at the Side of an Operator's Desk

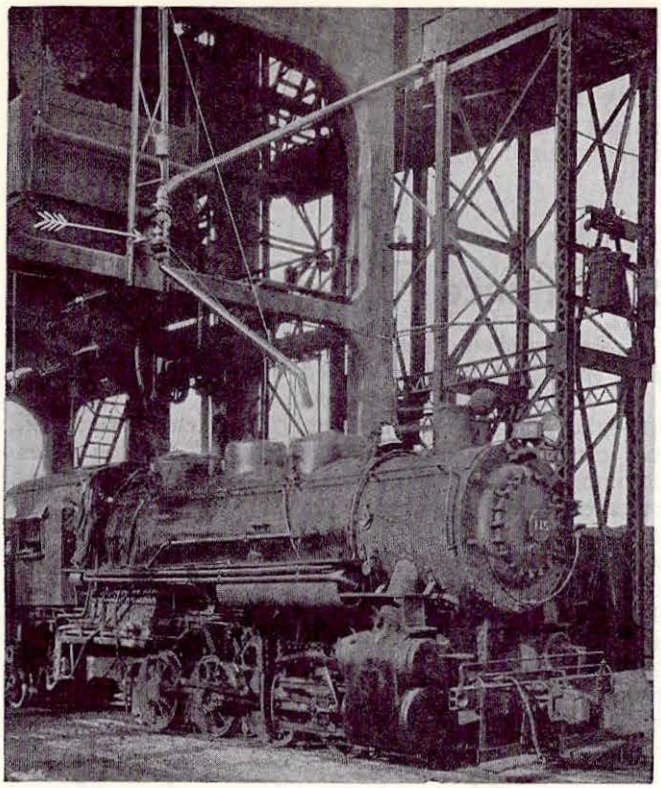
The field unit, comprising a steel cabinet, 22½ in. high, 19 in. wide and 10½ in. deep, contains the coded equipment at the field station. The front has a glass panel for observation of the relays and, on the back, there is a terminal board for external connections.

The equipment in both units is neatly wired in place so that it is necessary only to make external connections. The coded relays are of the C.T.C. plug-in type, so that any relay can easily and quickly be removed and replaced for inspection or tests.

The important features of the G.R.S. coded remote control system for single location are as follows: (1) All the advantages of coded control, with a minimum of equipment; (2) a maximum of four controls and seven indications over three line wires; (3) the small, compact, control-office and field units facilitate installation and maintenance; and (4) the control-office and field units can be easily moved from one location to another in case of changes.

New Loader Speeds Locomotive Sanding

THE Ross and White Company, Chicago, has developed a new design of sand loader for delivering sand to locomotives. The principal feature is the large-capacity, 5-in. delivery pipe and valve, which is said to deliver sand from overhead storage to locomotives at approximately four times the rate of the 3-in. sand valve heretofore employed. The design of the delivery spout is such that it can be revolved through 360 deg., thus making it possible to install a single loader between two parallel tracks and utilize the high-speed



R. & W. Fast Sand Loader

loading feature to serve locomotives on either track. At many combined locomotive coaling and sanding plants it has been possible heretofore to take coal in less time than is required to take sand, and the new loader has been designed to equalize the time required to perform the two operations. It is said that tests in regular service have shown that the new loader will deliver 2.6 tons of sand in three minutes.

Improved Car Retarder

AN improved electro-pneumatic car retarder, known as Model 31, is being introduced by the Union Switch & Signal Company, Swissvale, Pa. Construction of the new retarder is on the unit system, which provides any desired length of retarder. The new retarder retains all the advantageous features of previous designs and, in addition, gives the added advantages of flexibility of installation, minimum maintenance, maximum accessibility and fewer parts. The number of parts subject to wear is unusually small.

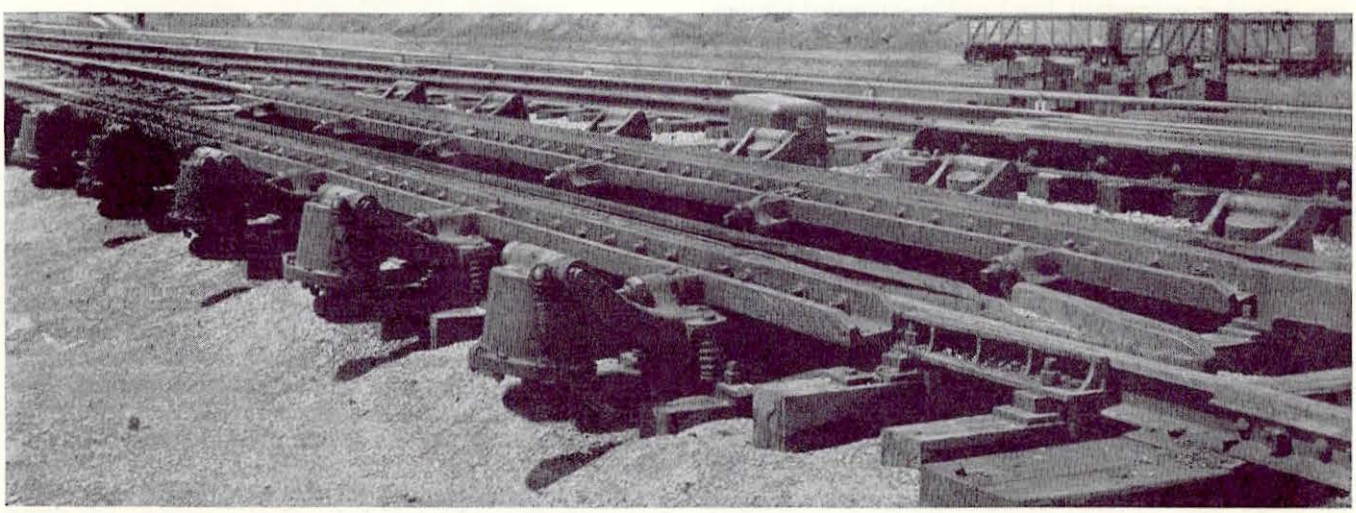
Any amount of retardation desired may be procured with the new retarder. Retardation can be had on both rails or on a single rail, and units may be added at will. Another outstanding advantage is that the new retarder does not require tangent track for its installation. This retarder is being introduced after most severe service tests over a period of approximately three years.

New Five-Point Safety Switch Control

FIVE points of safety control for switches are claimed as features of the new Positive signal stand manufactured by the Bethlehem Steel Company, Bethlehem, Pa. It is said that this device, besides fulfilling the usual functions of a switch stand, will also throw a derail in a turnout and actuate a distant signal indication, while its construction embodies a two-rod facing-point lock and detector-bar protection for the switch points. It is also claimed that it will completely safeguard any switch, no matter how remote, in track-circuit territory. In designing this stand, particular attention was given to providing ease of installation, facility of adjustment and ready accessibility for inspection and maintenance.

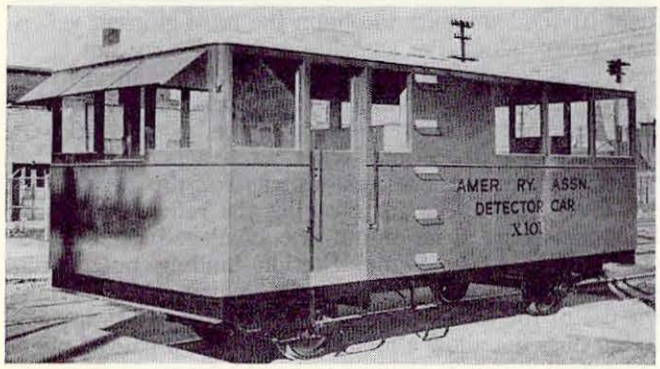
It is said that when the switch is being operated, a danger indication is given as soon as the switch-stand lever is lifted; that a distant signal is operated whenever the points are open more than ⅛ in.; and that the signal continues to give a stop indication until the points are returned to the closed position and the switch is locked for main track movements.

If the switch is run through, the detector bar, which is a part of the assembly, is actuated, closing an electric circuit which automatically sets the distant signal at danger. This signal then remains in the stop position until the damage is repaired and the points are restored to normal position. The switch points are double locked by means of two rods, when the switch is set for main-line movements. Obstructions between the point and the



The Model-31 Retarder Is Designed on the Unit System So as to Be Adaptable to Various Track Layouts

four-wheel chain drive and reverse gear, and is designed to operate with equal facility in either direction at all speeds. It is also equipped with air brakes, with a separate cylinder for each wheel. The entire chassis is mounted on leaf springs with patented thrust plates. Ready for operation, the tow car weighs 15,000 lb. and



The New AAR Detector Car

the detector car, fully equipped and with the water tanks filled, weighs 26,000 lb. Detection work is done at speeds ranging from four to eight miles an hour, but a maximum speed of 45 miles an hour can be attained when running to and from work.

Sleeping quarters, shower bath and lavatory facilities are provided for the crew in the tow car, there being three berths, each equipped with a box spring and mattress. Hot and cold running water are also provided, the exhaust from the engine being utilized to heat the water, while the necessary pressure is obtained from the brake reservoir.

Electric Lantern for Crossing Watchmen

TWO shielded spot lights, fore and aft, with red lenses, both of which operate at the same time, and a bottom white floodlight are features of a new electric lantern for crossing watchmen, which has been

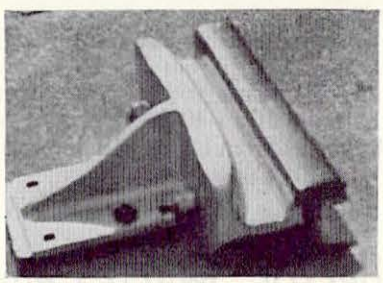
Delta Electric Lantern

placed on the market by the Delta Electric Company, Marion, Ind. It is said that the spot lights send out red beams of high intensity to control traffic in both directions, while the floodlight sends out more diffused rays. Both circuits are controlled by a simple double-acting switch which is used to turn on or off either the warning lights or the flood light for illumination.

This lantern was developed after exhaustive tests by safety officers of a number of roads and is said to be standard equipment for crossing watchmen on one large system. The device is of all-steel construction. It is furnished in silver color with chrome and black trimmings. The lights are operated on a standard six-volt lantern battery which is good for 40 hr. continuous discharge.

Switch-Point Guard

A NEW switch-point guard, which is claimed to give complete facing-point protection to the point, is being marketed as the Trego switch-point guard by the Morrison Railway Supply Corporation, Buffalo, N. Y. The Trego is an alloy casting about 15 in. long, mounted on a steel plate, and weighs approximately the same as the section of rail to which it is applied. The steel tie plate is ½ in. thick and 7 in. wide, the length varying with the section of rail to which it is applied. At the inner end there is a resting shoulder against which the casting is bucked; at the outer end a raised shoulder fits against the outside flange of the rail to which the guard is applied. The entire assembly consists of the casting, the tie plate, two heat-treated bolts to fasten the casting to the rail, two small bolts to fasten the casting to the plate, and spikes to hold the casting



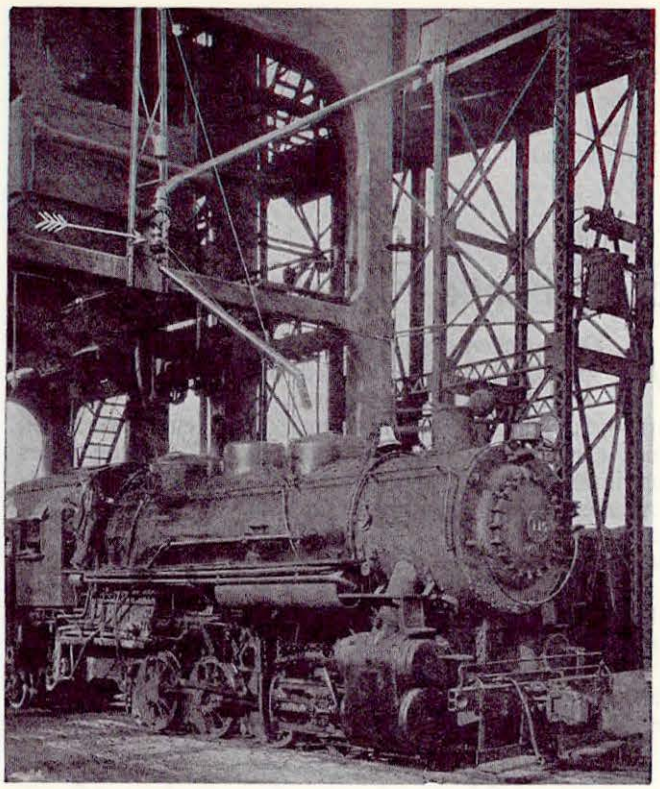
Trego Switch-Point Protector

and plate to the tie. The guard is mounted on a tie, 4 to 4½ in. ahead of and opposite the point to be protected. In operation, it engages the back of the wheel and draws the flange away from contact with the point.

An Improved Wood Preservative

AFTER long-continued research, the Grasselli Chemical Company, Cleveland, Ohio, has developed a new wood-preservative salt, known as chromated zinc chloride, which is said to possess the advantages of high initial and permanent toxicity, especially low leaching properties, physical permanence in the wood and low cost. This preservative is repellant to termites.

It is claimed that treatment with chromated zinc chloride increases the fire resistance of wood. The preservative itself is odorless and free from volatile components and poisonous organic and inorganic compounds. Wood treated with it is clean and will hold paint fully as well as untreated wood. No changes in equipment are required for applying this salt in any plant already equipped for treatment with zinc chloride. The procedure is essentially the same as with zinc chloride,



R. & W. Fast Sand Loader

loading feature to serve locomotives on either track. At many combined locomotive coaling and sanding plants it has been possible heretofore to take coal in less time than is required to take sand, and the new loader has been designed to equalize the time required to perform the two operations. It is said that tests in regular service have shown that the new loader will deliver 2.6 tons of sand in three minutes.

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New Five-Point Safety Switch Control

FIVE points of safety control for switches are claimed as features of the new Positive signal stand manufactured by the Bethlehem Steel Company, Bethlehem, Pa. It is said that this device, besides fulfilling the usual functions of a switch stand, will also throw a derail in a turnout and actuate a distant signal indication, while its construction embodies a two-rod facing-point lock and detector-bar protection for the switch points. It is also claimed that it will completely safeguard any switch, no matter how remote, in track-circuit territory. In designing this stand, particular attention was given to providing ease of installation, facility of adjustment and ready accessibility for inspection and maintenance.

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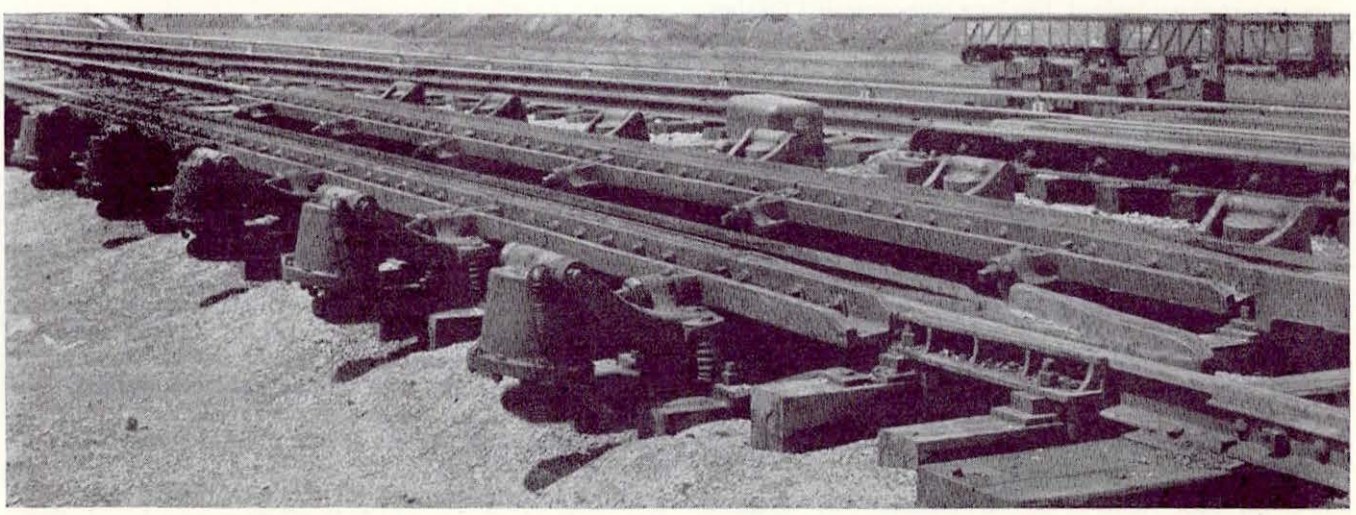

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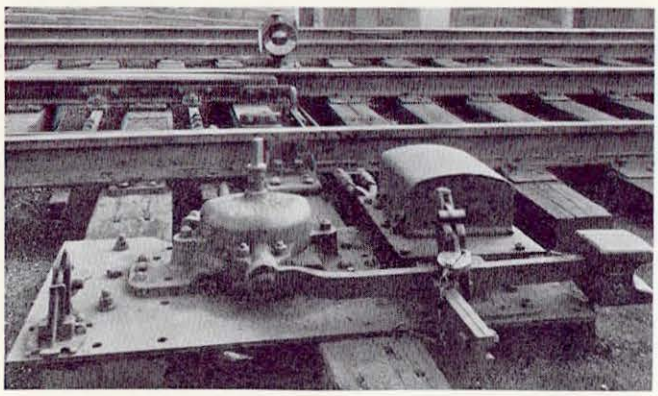


Bethlehem Heavy-Duty Positive Signal Stand

stock rail are easily detected because the throwing lever cannot be locked until the obstruction has been removed and the point is in contact with the rail. The siding derail is maintained closed or open to correspond with the position of the switch relative to through and turnout movements.

Copper-Bearing Sheets Have Long Life

TO increase the life of sheet-metal products, the Bethlehem Steel Company, Bethlehem, Pa., has developed copper-bearing steel sheets which it is marketing under the trade name of Beth-Cu-Loy, and which are claimed to have from 2 to 2½ times the life of ordinary sheets. The copper content ranges from 0.2 to 0.3 per cent, a range which is said to give iron and steel the highest resistance to atmospheric corrosion and brine drippings. Among the characteristics claimed for this product are uniformity and easy-working properties.

A recent application in railway service is the installation on the bridge now being built over the Mississippi river at New Orleans, La., in which Beth-Cu-Loy sheets were laid over the ties supporting the track on both approaches, to protect the steel-supporting structure from brine drippings as well as to reduce the fire hazard from live coals that may be dropped from locomotives on the open wooden deck.

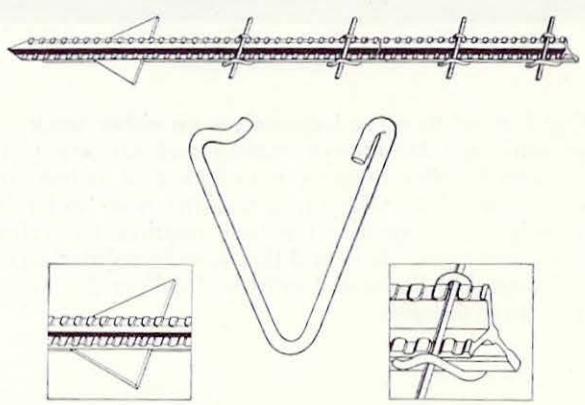
Beth-Cu-Loy sheets are supplied in standard gages and sizes, in either galvanized black or blue-annealed finishes. Corrugated sheets are made with 1¼, 2, 2½ or 3-in. corrugations, and in standard lengths of from 5 to 12 ft. V-crimped sheets are made with 2, 3, or 5 crimps, in lengths ranging from 5 to 12 ft., and in gages from 20 to 29, inclusive. Roll roofing is furnished in the galvanized finish, in gages from 24 to 29, inclusive, in a single width of 26½ in., and a length of 50 ft. to the roll.

Beth-Cu-Loy Deck Protection on the Mississippi River Bridge at New Orleans, La.

Steel Fence Post

AN improved design of its Studded "Y" steel fence post has been developed by the Republic Steel Corporation, Youngstown, Ohio. It is made of first-grade rail steel of uniformly high tensile strength, and it is claimed that the patented "Y" section gives maximum strength and rigidity by reason of the reinforcement of the stem and in the center of the post. The studs are prominent and closely spaced, and combined with the "Snap-Tite" fastener, also manufactured by this company, insure that the fence will be held securely in place. These special fasteners can be applied quickly and easily.

A broad anchor plate, made of rail steel and applied to the post without rivets, clamps or welds insures stability in service. The post is pointed accurately and can be driven easily in any kind of soil. Protection from the elements is afforded by a long-lasting enamel finish which is applied in two colors, the upper third of the post being orange and the remainder green.

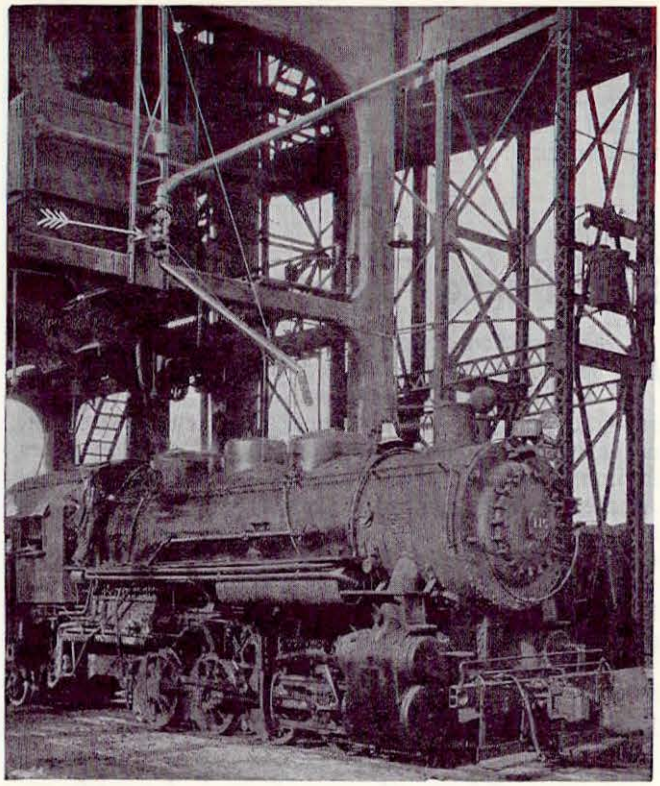


Details of Fence Assembly, Republic Studded "Y" Steel Fence Post

New Floor Plate Has Anti-Skid Surface

A NEW floor plate, known as Multigrip, has recently been announced by the Illinois Steel Company, Chicago, for use on stair treads and landings, elevated platforms, boiler-room and shop floors, machine footways and bridge decks, and as manhole covers, pipe-trench and drain covers in power houses and in other places where high skid resistance is desired. The design of the plate was developed through experimentation to assure the highest degree of skid resistance from every angle.

Other features claimed for this new plate are its comfort under foot, for which it offers a sure tread, there



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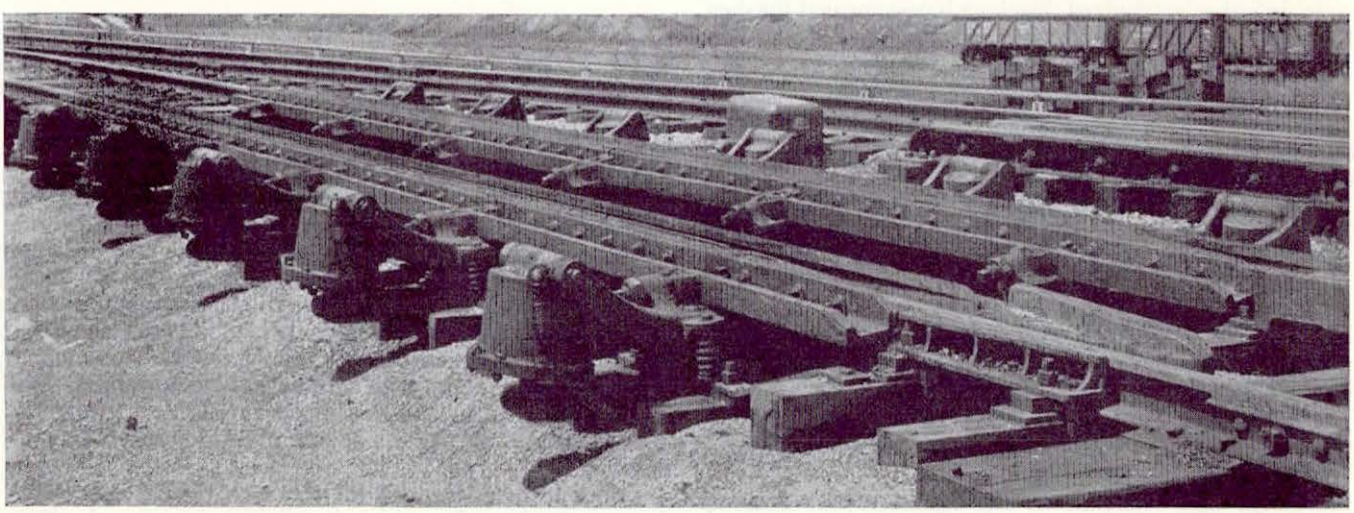
New Five-Point Safety Switch Control

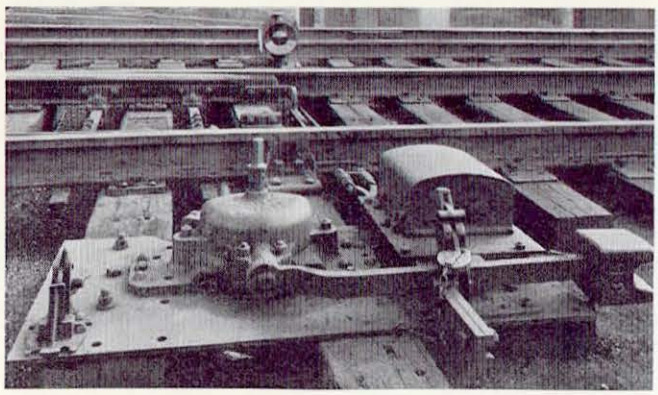
FIVE points of safety control for switches are claimed as features of the new Positive signal stand manufactured by the Bethlehem Steel Company, Bethlehem, Pa. It is said that this device, besides fulfilling the usual functions of a switch stand, will also throw a derail in a turnout and actuate a distant signal indication, while its construction embodies a two-rod facing-point lock and detector-bar protection for the switch points. It is also claimed that it will completely safeguard any switch, no matter how remote, in track-circuit territory. In designing this stand, particular attention was given to providing ease of installation, facility of adjustment and ready accessibility for inspection and maintenance.

It is said that when the switch is being operated, a danger indication is given as soon as the switch-stand lever is lifted; that a distant signal is operated whenever the points are open more than ⅛ in.; and that the signal continues to give a stop indication until the points are returned to the closed position and the switch is locked for main track movements.

If the switch is run through, the detector bar, which is a part of the assembly, is actuated, closing an electric circuit which automatically sets the distant signal at danger. This signal then remains in the stop position until the damage is repaired and the points are restored to normal position. The switch points are double locked by means of two rods, when the switch is set for main-line movements. Obstructions between the point and the



The Model-31 Retarder Is Designed on the Unit System So as to Be Adaptable to Various Track Layouts



Bethlehem Heavy-Duty Positive Signal Stand

stock rail are easily detected because the throwing lever cannot be locked until the obstruction has been removed and the point is in contact with the rail. The siding derail is maintained closed or open to correspond with the position of the switch relative to through and turnout movements.

Copper-Bearing Sheets Have Long Life

TO increase the life of sheet-metal products, the Bethlehem Steel Company, Bethlehem, Pa., has developed copper-bearing steel sheets which it is marketing under the trade name of Beth-Cu-Loy, and which are claimed to have from 2 to 2½ times the life of ordinary sheets. The copper content ranges from 0.2 to 0.3 per cent, a range which is said to give iron and steel the highest resistance to atmospheric corrosion and brine drippings. Among the characteristics claimed for this product are uniformity and easy-working properties.

A recent application in railway service is the installation on the bridge now being built over the Mississippi river at New Orleans, La., in which Beth-Cu-Loy sheets were laid over the ties supporting the track on both approaches, to protect the steel-supporting structure from brine drippings as well as to reduce the fire hazard from live coals that may be dropped from locomotives on the open wooden deck.

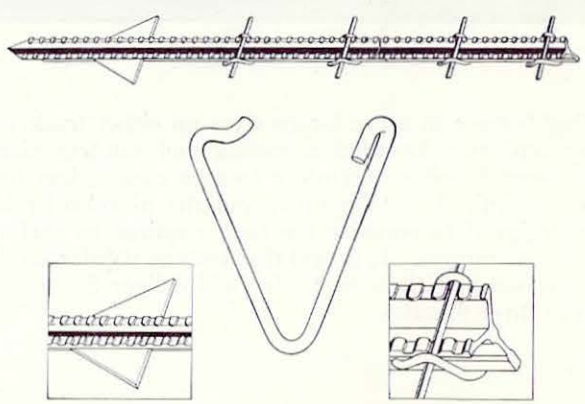
Beth-Cu-Loy sheets are supplied in standard gages and sizes, in either galvanized black or blue-annealed finishes. Corrugated sheets are made with 1¼, 2, 2½ or 3-in. corrugations, and in standard lengths of from 5 to 12 ft. V-crimped sheets are made with 2, 3, or 5 crimps, in lengths ranging from 5 to 12 ft., and in gages from 20 to 29, inclusive. Roll roofing is furnished in the galvanized finish, in gages from 24 to 29, inclusive, in a single width of 26½ in., and a length of 50 ft. to the roll.

Beth-Cu-Loy Deck Protection on the Mississippi River Bridge at New Orleans, La.

Steel Fence Post

AN improved design of its Studded "Y" steel fence post has been developed by the Republic Steel Corporation, Youngstown, Ohio. It is made of first-grade rail steel of uniformly high tensile strength, and it is claimed that the patented "Y" section gives maximum strength and rigidity by reason of the reinforcement of the stem and in the center of the post. The studs are prominent and closely spaced, and combined with the "Snap-Tite" fastener, also manufactured by this company, insure that the fence will be held securely in place. These special fasteners can be applied quickly and easily.

A broad anchor plate, made of rail steel and applied to the post without rivets, clamps or welds insures stability in service. The post is pointed accurately and can be driven easily in any kind of soil. Protection from the elements is afforded by a long-lasting enamel finish which is applied in two colors, the upper third of the post being orange and the remainder green.



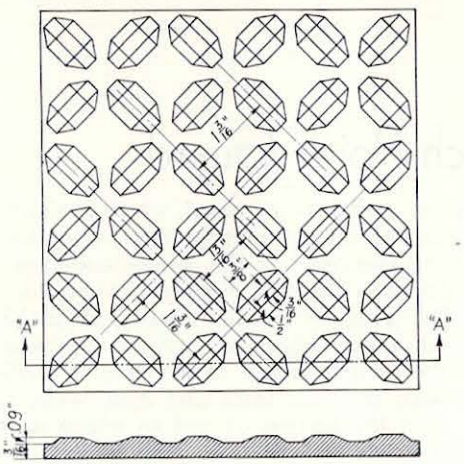
Details of Fence Assembly, Republic Studded "Y" Steel Fence Post

New Floor Plate Has Anti-Skid Surface

A NEW floor plate, known as Multigrip, has recently been announced by the Illinois Steel Company, Chicago, for use on stair treads and landings, elevated platforms, boiler-room and shop floors, machine footways and bridge decks, and as manhole covers, pipe-trench and drain covers in power houses and in other places where high skid resistance is desired. The design of the plate was developed through experimentation to assure the highest degree of skid resistance from every angle.

Other features claimed for this new plate are its comfort under foot, for which it offers a sure tread, there

being no sharp protruberances to catch the toe of the shoe, since all lugs have a flattened top surface and sloping sides. The spacing is such that the foot is always in contact with several risers at right angles to each other, the principle underlying the design being much



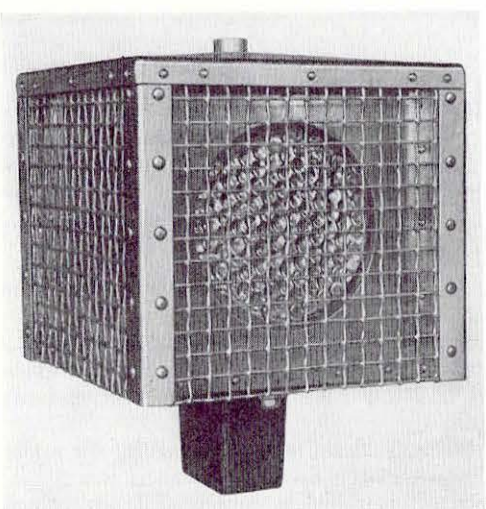
Multigrip Has Anti-Skid Surface

the same as that involved in modern non-skid automobile tires. Multigrip may be cleaned readily and drains freely, as there are no pockets in which water can accumulate. Its symmetrical design minimizes waste in cutting.

It is furnished in standard weights and sizes, the thickness ranging from 3/16 to 1/2 in., by increments of 1/16 in. Standard widths range from 6 to 84 in. and lengths from 10 to 40 ft., depending on the width. The weight varies from 8.7 to 21.5 lb. a sq. ft.

Reflector Switch Lamp

THE Western Railroad Supply Company, Chicago, has placed on the market a reflector-lens type switch lamp unit which is constructed entirely from sheet aluminum except for the socket for the switch stand staff



The Switch Lamp Reflector Is Protected by a Screen

which is an aluminum casting. It contains red and green Corning reflex combination units for night indication, which are protected from accidental or malicious breakage by a square mesh screen covering, with 1/2-in. mesh attached to the top plate or cover and to the side angles. It is claimed that this protective screen does not detract appreciably from the volume of light projected.

The socket for attaching the unit to the switch stand staff is available in several designs to fit various standard staffs. The socket provides for adjustment of the alinement of the lens units to obtain the most efficient reflection, even though the switch stand staff may not be in perfect alinement with the track, or where curves may require adjustment of the alinement to a position other than parallel to the center line of the adjacent track. A standard A. A. R. 1/2-in. socket wrench is required for making all adjustments, as well as for the removal of the cover and screen for cleaning the reflex lens units. Each cap screw head or nut is equivalent in size to the standard A. A. R., Signal Section binding nut and is surrounded with a close-fitting loose ring which permits the use of the socket wrench for loosening and tightening it, but does not allow a monkey wrench or a pair of pliers to be used. This is claimed to be of advantage since unauthorized persons cannot tamper with the unit; yet no special tool is required to be carried by authorized employees.

No colored background is considered necessary on these lamp units as the regular switch target gives ample daylight indication. By furnishing these lamps in dull-finished aluminum, no repainting or refinishing is required. It is claimed that this contributes to long service life and economy.

AAR Gets New Cars for Detector Equipment

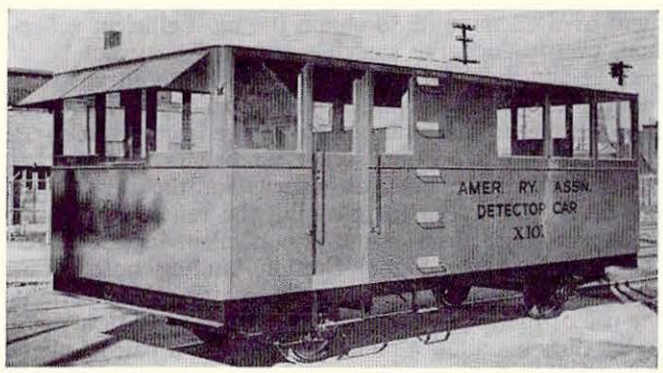
AT the end of 1934, the AAR detector car completed its sixth year of service under the direction of the Rail committee of the A.R.E.A. During this year the detector equipment was transferred to a new car of the trailer type that is much larger and heavier than the old detector car and which was specially designed for this service. At the same time, a new tow car was provided so that the outfit is now self-contained and able to move under its own power.

Formerly, the roads using the detector car were required to provide the towing service, but since only a few roads possessed tow cars that were adequate to meet the exacting conditions of this service, some of those that were provided failed and serious delays were experienced with others. To eliminate these difficulties, the new tow car has been designed to provide ample power, speed and operating flexibility to meet the various conditions that have been encountered in the field.

Both cars were built by The Buda Company, Harvey, Ill., and are alike in construction except for certain details necessary to accommodate the engine mounting in the tow car. The frames are fabricated from 8-in., 19-lb. channels, with all joints welded. The wheel base of the detector car is 12 ft., while that of the tow car is 10 ft. This wheel base of 12 ft. compares with 8 ft. 5 1/2 in., in the original detector car, and as the length of the car body has also been increased by 7 ft. 3 in., a much better arrangement of the detecting equipment is permitted, with more room for the operators and the railway's representatives, while the riding qualities are much superior to those of the former car.

The tow car is self-propelled by means of a Buda 112-hp. Model L-525 engine. It is equipped with a

four-wheel chain drive and reverse gear, and is designed to operate with equal facility in either direction at all speeds. It is also equipped with air brakes, with a separate cylinder for each wheel. The entire chassis is mounted on leaf springs with patented thrust plates. Ready for operation, the tow car weighs 15,000 lb. and



The New AAR Detector Car

the detector car, fully equipped and with the water tanks filled, weighs 26,000 lb. Detection work is done at speeds ranging from four to eight miles an hour, but a maximum speed of 45 miles an hour can be attained when running to and from work.

Sleeping quarters, shower bath and lavatory facilities are provided for the crew in the tow car, there being three berths, each equipped with a box spring and mattress. Hot and cold running water are also provided, the exhaust from the engine being utilized to heat the water, while the necessary pressure is obtained from the brake reservoir.

Electric Lantern for Crossing Watchmen

TWO shielded spot lights, fore and aft, with red lenses, both of which operate at the same time, and a bottom white floodlight are features of a new electric lantern for crossing watchmen, which has been

Delta Electric Lantern

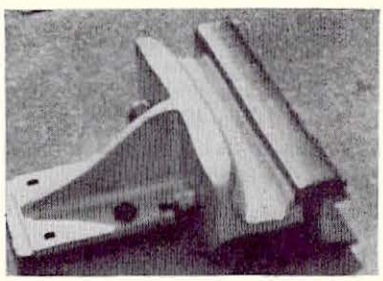
placed on the market by the Delta Electric Company, Marion, Ind. It is said that the spot lights send out red beams of high intensity to control traffic in both directions, while the floodlight sends out more diffused rays. Both circuits are controlled by a simple double-acting switch which is used to turn on or off either the warning lights or the flood light for illumination.

This lantern was developed after exhaustive tests by safety officers of a number of roads and is said to be standard equipment for crossing watchmen on one large system. The device is of all-steel construction. It is furnished in silver color with chrome and black trimmings. The lights are operated on a standard six-volt lantern battery which is good for 40 hr. continuous discharge.

Switch-Point Guard

A NEW switch-point guard, which is claimed to give complete facing-point protection to the point, is being marketed as the Trego switch-point guard by the Morrison Railway Supply Corporation, Buffalo, N. Y. The Trego is an alloy casting about 15 in. long, mounted on a steel plate, and weighs approximately the same as the section of rail to which it is applied. The steel tie plate is ½ in. thick and 7 in. wide, the length varying with the section of rail to which it is applied. At the inner end there is a resting shoulder against which the casting is bucked; at the outer end a raised shoulder fits against the outside flange of the rail to which the guard is applied. The entire assembly consists of the casting, the tie plate, two heat-treated bolts to fasten the casting to the rail, two small bolts to fasten the casting to the plate, and spikes to hold the casting

Trego Switch-Point Protector



and plate to the tie. The guard is mounted on a tie, 4 to 4½ in. ahead of and opposite the point to be protected. In operation, it engages the back of the wheel and draws the flange away from contact with the point.

An Improved Wood Preservative

AFTER long-continued research, the Grasselli Chemical Company, Cleveland, Ohio, has developed a new wood-preservative salt, known as chromated zinc chloride, which is said to possess the advantages of high initial and permanent toxicity, especially low leaching properties, physical permanence in the wood and low cost. This preservative is repellant to termites.

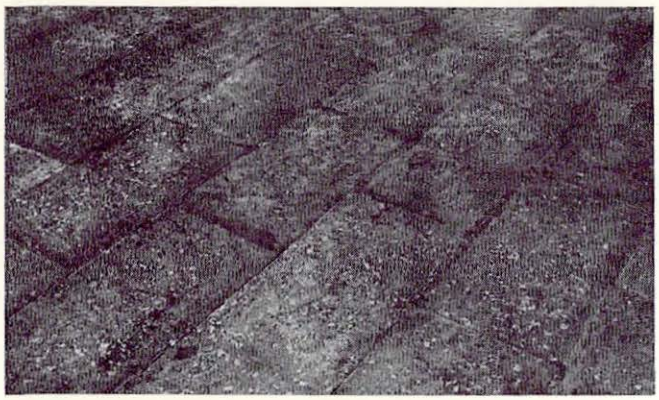
It is claimed that treatment with chromated zinc chloride increases the fire resistance of wood. The preservative itself is odorless and free from volatile components and poisonous organic and inorganic compounds. Wood treated with it is clean and will hold paint fully as well as untreated wood. No changes in equipment are required for applying this salt in any plant already equipped for treatment with zinc chloride. The procedure is essentially the same as with zinc chloride,

and the methods of treatment given as recommended practice in the Manual of American Wood Preservers' Association are adapted for use with this salt, while expert supervision is unnecessary for the preparation of the treating solution.

Pressure treatment is recommended, with a net retention of 0.75 lb. of the salt. Tests have shown that with this retention the wood will contain not less than 0.5 lb. of unaltered zinc chloride per cubic ft. This preservative is said to be suitable for treating ties, building lumber, bridge timbers, fence materials and car lumber.

Mineral-Surfaced Asphalt Bridge Plank

JOHNS-MANVILLE, New York, has introduced an improved type of asphalt bridge plank which is said to embody all the advantages of the standard material but with greatly increased traction as an added feature. The desired surface texture is obtained by the introduction of coarse trap rock as the mineral aggregate. By a special manufacturing process, this trap rock is embedded in the surface under hydraulic pressure, permanently interlocking the stone with the asphaltic body of the plank. The pressure under which the material is formed also increases its density and toughness.

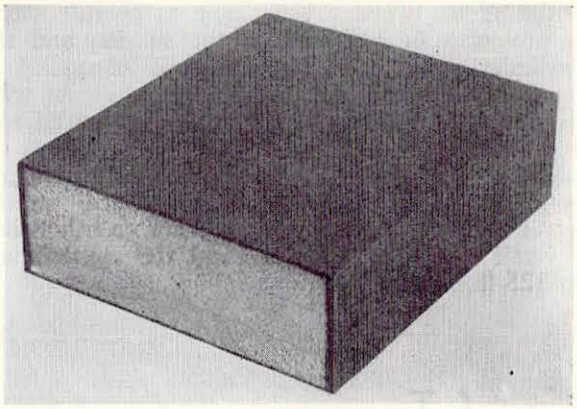


The Trap Rock Provides a Non-Skid Surface

A New Cold Storage Insulation

INSULATION for cold rooms, ice storage, refrigerator cars and similar facilities must not only meet the requirement of low heat conductivity but must also be waterproof, because the absorption of the water to which such insulation is exposed will result in a rapid increase in conductivity. To meet this rigid requirement, the Insulite Company, Minneapolis, Minn., has introduced an insulating material for use in installations subject to the presence of moisture or free water, known as Insulite Sealdslab.

In this new product the slabs of insulating material, 4 in. thick and available in widths and breadths up to 48 in., are impregnated on all surfaces with a waterproofing that forms a water-repelling shield ⅛ in. deep. These slabs are dipped in asphalt before application and when covered with a mastic protection provide an insulation highly resistant to deterioration from water. Owing to the sizes of the slabs available, the work of application is reduced, as is the labor and expense involved in securing them in position.

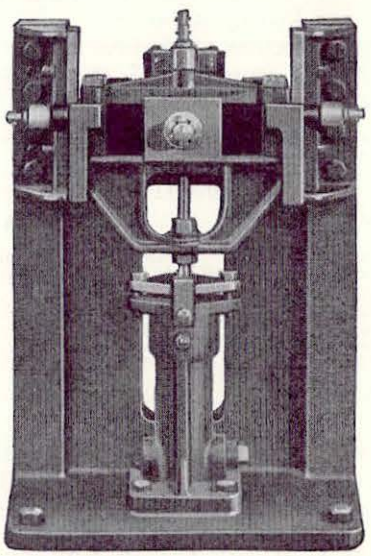


A Small Slab of the Insulite Sealdslab

New Chemical Pump Proportions Precisely

A NEW chemical pump, for which patent has been applied, is announced by the Dearborn Chemical Company, Chicago, which has been designed to provide means for pumping exact quantities of water-treating chemicals into raw-water supplies and for varying the quantity with the rate of flow of the water. The pump is also adapted for use with any kind of liquid or semi-liquid chemicals and for the precise proportioning of coagulants.

It is said that the pump runs smoothly and evenly without slippage, at all operating speeds, by reason of centered ball bearings and a guided plunger, and that stroke adjustment can be made accurately with ordinary



Dearborn Chemical Pump

tools, for travels up to 3 in., with complete cylinder displacement to eliminate accumulations of air. The plungers are made of a special alloy and all other working parts are of nickel semi-steel. Plungers and cylinders are interchangeable in diameters from ½ to 3 in., the ½ in. cylinder being able to operate safely up to pressures of 1,800 lb. to the sq. in., and the 1-in. cylinder up to 1,000 lb. Pressure lubrication is employed throughout. The pump has been designed with a view to extended periods of service without adjustments or replacements.

Any type of actuating device may be used to operate this pump, including water power, electric motor, ratchet or reciprocating motion, or chain or belt drive. The overall height is 23½ in., and the approximate weight 125 lb.

Effect of Tonnage on Fissure Growth

WHAT influence does tonnage have on the rate of growth of transverse fissures? For the purpose of developing information that might provide the answer to this question, Sperry Rail Service made a study of fissure growth in nine rails in which the fissures had been detected by Sperry detector cars during regular testing operations. The results of this study show that while tonnage plays an important part in fissure development, the rate of growth depends on several factors not known at present.

TABLE I

Rail No.	Tons Traffic Per Day	Size When Detected Per Cent Rail Head Section	Size When Removed Per Cent Rail Head Section	Days in Track Following Detection	Increase in Size Per Cent
1	11,000	8.5	12	18	3.5
2	19,000	20	23	18	3
3	32,000	16	24	21	8
4	35,000	26	37	20	11

Following the detection of fissures in the nine rails, relieving angle bars were placed at the locations of these fissures and the rails were left in track for recording fissure growth. Within three weeks following the detection of the fissures and before the rails failed, four of them were removed from track, by the railroad, with results shown in Table I. Data for the other five rails, which were left in the track until failure, is given in Table II.

TABLE II

Rail No.	Tons Traffic Per Day	Size When Detected Per Cent Rail Head Section	Size at Failure Per Cent Rail Head Section	Days in Track Following Detection	Increase in Size Per Cent
5	43,000	37	57	52	20
6	43,000	32.5	57	46	24.5
7	50,000	17	66	134	49
8	43,000	30	89	93	59
9	50,000	31	90.5	131	59.5

The accompanying chart shows the rate of growth of the fissures in rails 6, 7, 8 and 9. In this chart the time axes have been shifted so that the growth is shown from a point where all fissures are the same size (32.5 per cent) to point of failure. From this chart it will be seen that, after a given size had been reached, one of the rails which carried the heaviest traffic failed in a short time after a rather precipitous growth, whereas the other rail carrying heaviest traffic had the longest life in track before failure, with slower growth.

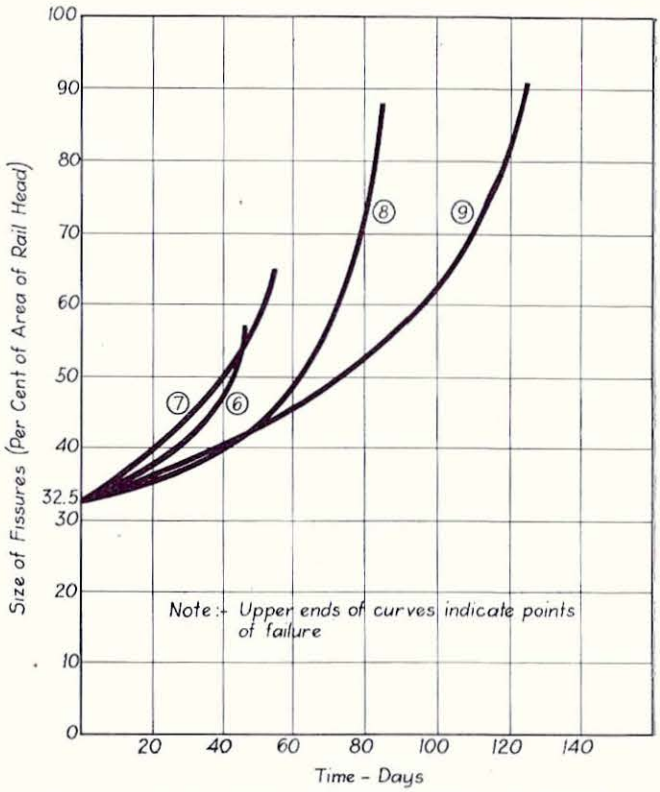
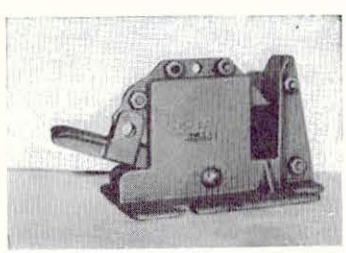


Chart Showing the Growth of Fissures in Rails 6, 7, 8 and 9

Barber Patented Automatic Switch Latch

THE Peerless Manufacturing Corporation, Louisville, Ky., has placed on the market an improved design of automatic foot latch for hand-throw switch stands under the trade designation of the Barber switch latch. The latching mechanism is of split construction, being held together by means of five ⅜-in. bolts securely locked with spring lock washers. All of the castings used in the device are of malleable iron. The plunger is forced into position by a helical steel spring which is entirely within the housing to protect it from the weather and mechanical injury. The latch is designed so that it can be locked with a padlock, which can be fastened to the latch with a chain.



Barber Switch Latch

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MODERN POWER

Makes the RAILROAD!

Net tons per mile of road per day is the measure of the effectiveness of the transportation plant.

In this, locomotives are the key element — track, terminals, yards and every other facility are only as useful as the locomotives are efficient.

Only by use of modern Super-Power Steam locomotives can maximum net returns be assured.

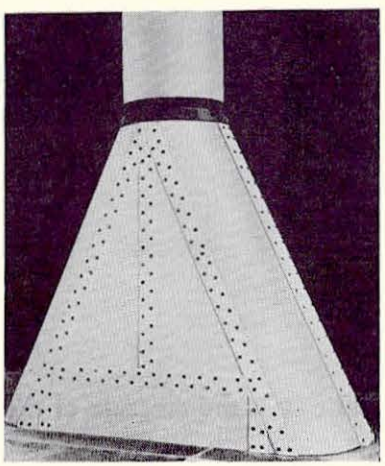
LIMA LOCOMOTIVE WORKS INCORPORATED

LIMA LOCOMOTIVE WORKS, INCORPORATED, LIMA, OHIO

Improved Type of Transite Smoke Jack

A NEW type of smoke jack, constructed largely of transite pipe, has been developed by Johns-Manville, New York. The corners of the hood consist of four quadrants of transite pipe fastened together with tapered battens to provide the desired flare. The sides of the hood are flat transite, fastened to the corner sections with specially-shaped battens. The quadrants are manufactured under pressure to the desired shape and cured under conditions that result in a much stronger corner construction than can be obtained when the material is formed flat, and shaped to the desired curvature after initial set has taken place.

The smoke-jack stack is constructed of a single length of transite pipe for most designs of roundhouses. Because all fastenings are eliminated except the bolts and nuts required to secure the stack to the hood, erection costs are greatly reduced and the danger of stack failure



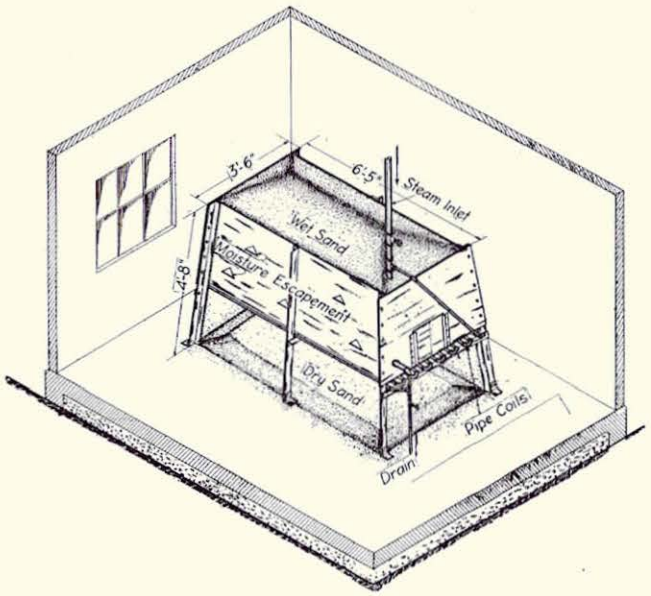
The New Smoke Jack

due to the corrosion of metal fastenings is practically eliminated.

The transite pipe stack is said to be especially suited to withstand strains due to differences between inside and outside temperatures. Friction losses are also minimized because of the unusually smooth interior surface of transite pipe, and the elimination of bolt heads, protective coatings, and joints.

Large Capacity Steam Sand Dryer

A NEW steam sand dryer which service tests have shown to possess the advantages of large capacity, quick drying and flexibility of installation and use, is announced by the Ross and White Company, Chicago. It has a capacity of from 15 to 17 tons of dry sand per day. It is approximately 4 ft. wide and 7 ft. long at the bottom and contains a series of 15 horizontal pipes running through the body of the sand which is confined in a steel box. An additional series of 25 steam pipes form the bottom of the wet-sand compartment, and



Improved Sand Dryer

apertures are provided in the side plate to permit vaporized moisture to escape.

This dryer is suitable for use in all-gravity sanding plants, in which the wet sand is fed from overhead storage to the dryer and from the dryer to a sand elevating drum for elevation to the delivery bin by compressed air. It may also be used in the ground storage type of plant where sand is transferred manually from the wet-sand bulkhead to the dryer.

Cleaning doors are provided through which refuse accumulated from the sand may be disposed of. The drying process is continuous, heat being supplied to the unit through a 1½ in. steam line, and the condensation is bled from the system into a tank, or disposed of otherwise as conditions permit. The dryer is automatic in the sense that it requires no labor for attending to fires or removing ashes. The arrangement of pipes is such that the wet sand is retained within the enclosure, while the dry sand falls by gravity through the openings in the bottom.

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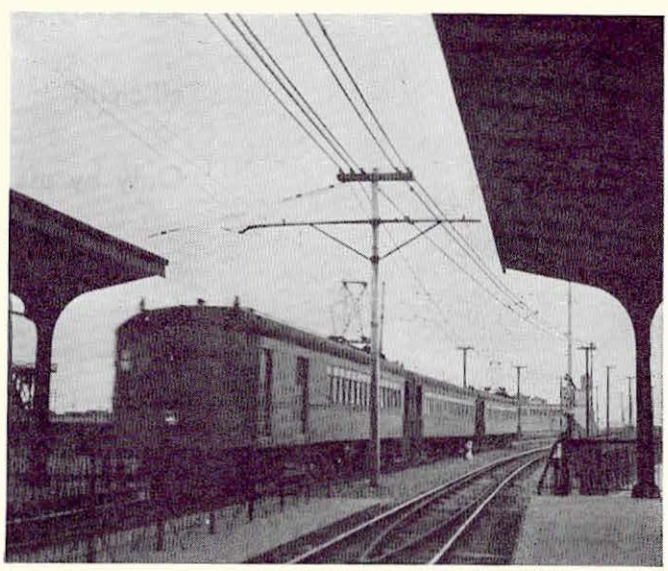


A Southern Pacific Suburban Train at Sixteenth Street Station Oakland, Cal.

News Department begins on next left-hand page

Of course it takes more tractive power to start a heavy train than it does to keep it rolling after it reaches road speed.

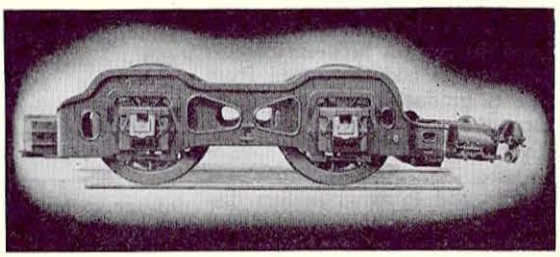
To provide this high tractive effort for starting necessitates larger cylinders to develop the power and perhaps an extra pair of drivers to provide sufficient adhesive weight—unless the locomotive is Booster equipped.

The Booster, by driving the trailer or tender wheels, provides the extra power needed for starting without the use of larger cylinders and the corresponding increase in locomotive weight and maintenance that larger cylinders bring.

It avoids the need of hauling this excess weight around every mile the engine works.

In other words the locomotive is proportioned for road speeds which permits lower locomotive weights and correspondingly lower maintenance and operating costs.

Capitalize idle weight and spare steam.



When maintenance is required a replacement part assumes importance equal to that of the device itself and should be purchased with equal care. Use only genuine Franklin repair parts in Franklin equipment.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK CHICAGO MONTREAL

NEWS

Jones Anticipates Little Loss on R.F.C. Rail Loans

Lending agency's chairman says such advances, with few exceptions, are well secured

The opinion that "on the whole the government will sustain little loss through our loans to railroads" was expressed by Jesse H. Jones, chairman of the Reconstruction Corporation, in an address before the St. Louis Chamber of Commerce on March 8. He said that, with few exceptions these loans are well secured. He also said in part:

"We have recently been authorized to lend to railroads for certain maintenance and improvement purposes, and to assist in the reorganization of those roads that will need to readjust their capital structures and to reduce their fixed charges.

"In these reorganizations, security holders will find it necessary to accept lower interest rates, and much of their income on an 'if-earned' basis. In some instances creditors will need to accept stock in the road as part payment of their debts, and stockholders may need to subordinate and scale down their principal. But so long as the relative positions are fairly maintained, the security holder can get the equivalent of what he now has.

"Some security holders are opposed to reorganizations on the basis of present, recent and probable earnings, feeling that when recovery is further along they will get a better bond.

"I question the soundness of this attitude. But in justice to the bondholder, if an income bond is accepted in place of a fixed-interest bond, payable only, but if earned, his position should be safeguarded. After al', the roads can only pay with their net earnings, and the margin between the *cost* of rendering service and the *return* from that service is gradually getting smaller. This is because of new operating charges, decreased volume, and encroaching competition.

"These facts, and to avoid further disruption of values, make regulation and fair competition between all forms of transportation service a necessity, not in the interest of the railroads alone, but of all interstate transportation.

"Railroads will benefit by increased traffic when building and construction start again, but we cannot go on building and maintaining highways at public expense to compete with privately-owned railroads, unless we regulate competition, and fair competition is as essential for highway transportation as it is for railroads."

I.C.C. Examiner Finds Georgia State Fare Not Discriminatory

Examiner Charles W. Berry, of the Interstate Commerce Commission, has recommended to the commission in a proposed report a finding that the maximum passenger fare of 2 cents a mile prescribed by the Georgia Public Service Commission for intrastate traffic in March, 1934, has not been shown to be unduly discriminatory against interstate commerce. The report says the railroads offered no evidence bearing on the reasonableness of the interstate rates but had asked the commission to find that a rate of 3 cents a mile without surcharge is not unreasonable and to prescribe it in Georgia, while they were at the same time experimenting with fares ranging from 1½ to 3 cents a mile.

New Industries on Missouri Pacific

A total of 497 new industries located on Missouri Pacific Lines during 1934. These plants have a total capital investment of $12,630,720 and, according to estimates, will produce 92,019 carloads of freight annually.

Material from Passenger Traffic Report Included in I. C. C. Record

The Interstate Commerce Commission has over-ruled the motion filed by counsel for the railroads asking to have stricken from the record of the hearings in connection with its investigation of passenger fares statistical material taken from the "Passenger Traffic Report" prepared by the Co-ordinator's Section of Transportation Service and testimony relating to it.

R. V. Fletcher Discusses Government Ownership in Theory and Practice

R. V. Fletcher, vice-president and general counsel of the Association of American Railroads, discussed government ownership in theory and practice in an address delivered on March 15 before the Traffic Club of Chicago. Mr. Fletcher presented some comparisons between railroad history in the United States with that of countries where roads are publicly owned.

Old Tires Salvaged to Quiet Baggage Trucks

The Chicago & North Western is using worn automobile tires on baggage truck wheels to reduce noise in passenger stations. The tires are trimmed to fit the steel-tired trucks and have been very effective and useful, especially where trucks are drawn across concrete platforms near parked sleeping cars.

Water Carrier Bill Before Two Committees of Senate

Eastman repeats previous testimony for benefit of three members of committee on commerce

Joseph B. Eastman, federal co-ordinator of transportation, was called on for another kind of co-ordination on March 11, when he was suddenly called on to repeat for the benefit of three members of the Senate committee on commerce testimony he had given two weeks previously before about the same number of members of the Senate committee on interstate commerce as to the reasons for the enactment of his bill, S. 1632, for the federal regulation of water transportation by the Interstate Commerce Commission. Because the commerce committee felt that the bill ought to have been referred to it, Chairman Wheeler of the committee on interstate commerce had invited members of the other committee to sit with it in joint session on the water carrier bill. Three of them were present, as well as four members of the interstate commerce committee, and the room was full of prospective witnesses interested in water transportation ready to testify, but Chairman Copeland and the other members of the commerce committee objected to proceeding without an explanation of the need for such a bill and as none of the Senators present were able to explain it, it was decided to send for Mr. Eastman again, rather than require them to read the record. Chairman Wheeler, who had introduced the bill, was absent because he was ill. J. C. Peacock, director of the Shipping Board of the Department of Commerce, was given an opportunity to testify but said his position was rather critical of the bill and he made only a general statement while the Senators were waiting for Eastman to arrive.

Mr. Peacock said he was not exactly for or against the bill but that he felt that regulation was "more or less of a necessary evil" and that "we should not bite off more than we can chew." He urged the members of the committee to satisfy themselves of the necessity for various mandatory provisions of the bill and said he was rather against the idea of including various provisions taken from the interstate commerce act unless the necessity for them were shown. He said that for many years the regulatory functions of the Shipping Board had been subordinated to the administration and liquidation of a $3,000,000,000 project and that only recently had any serious progress been made

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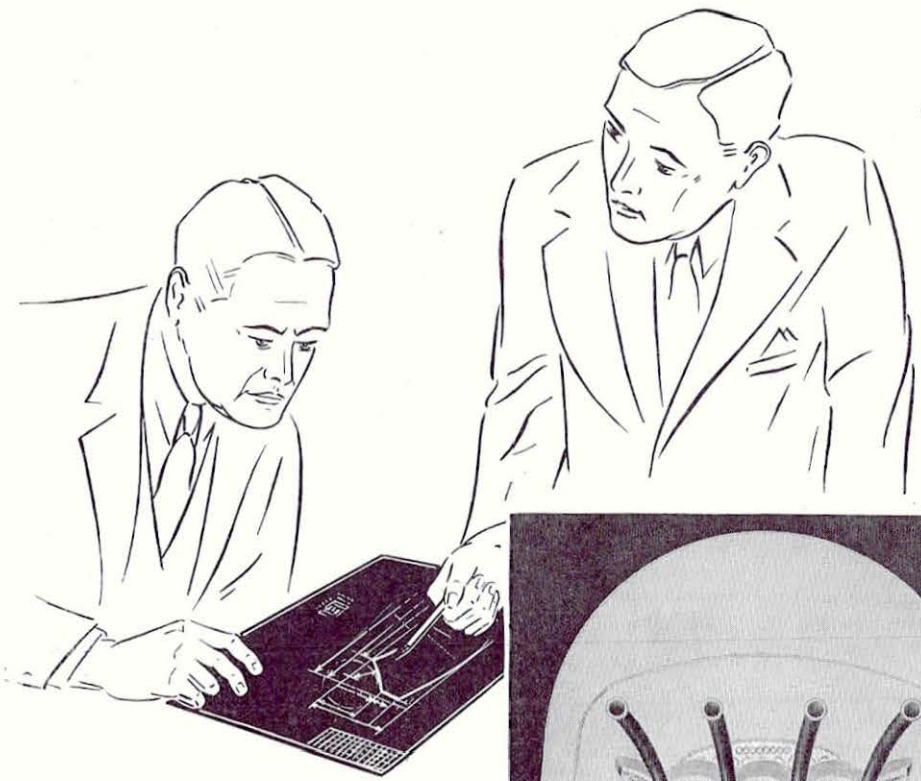
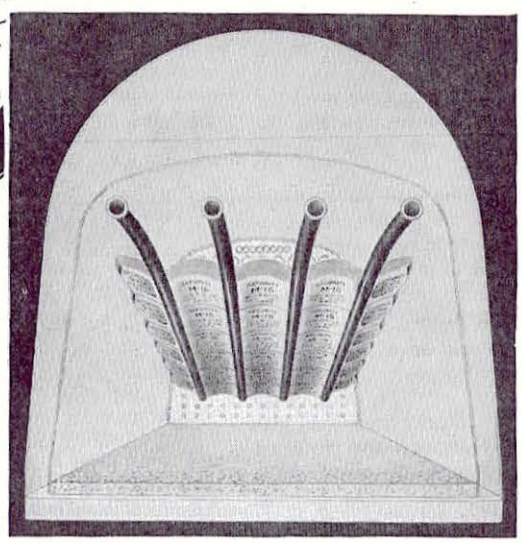
Security Arches...





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American Arch Company engineers have specialized on locomotive combustion problems and know the conditions of service under which arch brick must work.

All former railroad men, they have devoted their lives to the improvement of locomotive fuel economy.

These men in collaboration with Ceramic Engineers have designed Security Arch Brick to meet locomotive needs — to deliver maximum economies and service.

Security Brick Arches are, today, the least expensive of all recognized fuel economy factors.

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under its regulatory functions. He questioned as to whether any government agency could assimilate in a year or two "such a new and comprehensive system of regulation as is here proposed."

Mr. Eastman restated in brief form what he had said before and had included in his report as to the necessity for coordinating the regulation of all forms of transportation under a single commission, unless the country is to return to a system of unrestrained competition, and pointed out that water transportation is now only partially regulated, in some respects by the Shipping Board Bureau and in some others by the Interstate Commerce Commission. The latter has jurisdiction over joint rail-and-water rates and over the port-to-port rates of water carriers controlled by railroads and the Shipping Board has certain jurisdiction over carriers on the ocean in domestic commerce and on the Great Lakes but none over the carriers on inland waterways. It seemed to him quite clear, he said, that if there is to be comprehensive regulation of transportation to promote greater order and stability it was highly desirable that the jurisdiction should be in a single agency and he described the reorganization of the Interstate Commerce Commission he has proposed for that purpose. Taking up various details of the bill he emphasized the need for some control over entrance into the industry by the requirement of certificates of public convenience and necessity for common carriers and permits for contract and private carriers. He said the provisions of the bill include only such regulation of contract and private carriers as is necessary to protect common carriers against unfair competition.

The hearing was adjourned until Wednesday when Mr. Peacock was recalled. He said he had not studied the bill to any great extent, since regulation was only one of about six of the different functions of his bureau, one of which is the operation of 37 ships. The bill, he said, would transfer to the Interstate Commerce Commission only the Division of Regulation of his bureau. He thought some extension of the rate-making power over water transportation would be desirable but was fearful that it would impose too much on the regulating authority at one time, and said that his comments were largely influenced by the fact that his bureau had found it a real task to administer such functions as it has. When he said that there was so much competition between rail and water transportation that there were many reasons why they should be regulated by the same agency, Senator Couzens remarked: "so there would be no competition between agencies," and Senator Shipstead said he was in favor of competition between agencies.

Edward P. Farley, chairman of the executive committee of the American-Hawaiian Steamship Company, appearing on behalf of a group of common-carrier steamship lines operating in coastwise and foreign service, strongly favored passage of the bill, saying it would coordinate the various degrees of regulation to which ship lines have been subject. He said existing regulation has not satisfactorily stabilized rates and has created a situation under which the lines have not been able to operate without heavy loss and have been wearing out their property. "We have suffered for fourteen years with unregulation," he said, "and would like to try regulation." Congress has laid down a policy that the merchant marine should be built up but it has not provided the means. I was for a time chairman of the Shipping Board but it was not much interested in regulation; it was more fun to run the 'Leviathan.'" Mr. Farley said he did not consider the present situation fair under which the railroads are strictly regulated while their competitors are free to cut rates and also that he wanted to "know what the other fellow is charging so I can build a ship to compete with him." He expressed a hope that Congress would not repeal the long-and-short-haul clause, saying such a step would be disastrous for everybody, including the railroads.

E. L. Hart, traffic manager of the Atlanta Freight Bureau, spoke in favor of regulation of all forms of transportation and the reorganization of the Interstate Commerce Commission as proposed in Coordinator Eastman's report. He said those he represented were more concerned with stable transportation than with free and unregulated competition and that Eastman's report was the first comprehensive and completely unbiassed report on the subject.

Nevada Train Limit Bill Signed

The Nevada 70-car train limit bill has been signed by Governor Kirkman and becomes effective May 11, unless legal relief is granted by the courts.

P.W.A. Railroad Program About 90 Per Cent Complete

The program of railroad maintenance and improvements financed with loans of nearly $200,000,000 by the Public Works Administration is about 90 per cent complete, according to a statement issued by the P.W.A. on March 1. Of the 18,863 P.W.A. projects as a whole about 60 per cent had been completed.

Railway Employment in February

Class I railways have reported to the Interstate Commerce Commission a total of 968,952 employees as of the middle of the month of February, an increase of 1.05 per cent as compared with the number in January but a decrease of .71 per cent as compared with February, 1934. This is 54.2 per cent of the average for 1923-1925.

New Equipment

Class I railroads on February 1 had 818 new freight cars on order, according to reports received by the Association of American Railroads. On the same day last year 732 new freight cars were on order and on the same date two years ago, there were 2,223. The railroads on February 1 also had 5 new steam locomotives and 80 new electric locomotives on order.

In January, 1935, the railroads installed 216 new freight cars. In the same period last year, only two new cars were placed in service and in the same month two years ago, the total number installed was 225. Five new steam locomotives and ten new electric locomotives were placed in service in January this year. The railroads installed no steam locomotives in January, 1934, or January, 1933. Freight cars and locomotives leased or otherwise acquired are not included in the above figures.

Investigation of Clerk's Compensation Proposed

Representative Moritz, of Pennsylvania, has introduced a bill, H. R. 6461, to authorize the President to appoint a committee to conduct an investigation "with a view to having the chief clerks' and clerks', employees of railroad companies, salaries increased to the same comparative level as the trainmen, or to have a 25 per centum increase in their wages, with back pay dating from February 1, 1932."

Brotherhood Chief Wins Reversal of Decision

Alvaney Johnston, grand chief of the Brotherhood of Locomotive Engineers, on March 7 won a reversal of his conviction for having misapplied funds of the defunct Standard Trust Company, of which he was chairman of the board. C. Stirling Smith, former president of the institution, is now serving a sentence of 3 to 37 years in the penitentiary at Columbus, Ohio, having withdrawn his appeal in the case. Johnston and Smith were convicted a year ago for the misapplication of $450,000 and false entries. Mr. Johnston was never sentenced.

Train Wreckers Accused of Murder

The deliberate wrecking of a Pennsylvania passenger train at Columbus, Ohio, on December 27, when 3 trainmen were killed and 16 passengers were injured, resulted in first degree murder charges against 3 Columbus men at a trial in that city on March 9. The train entered an open switch on a siding and ran into a string of empty box cars, the locomotive being overturned and the coaches derailed. Hubert Lindsey, Victor Tomlinson and Hugh Brockman were charged with "unlawfully and maliciously tampering with a railroad switch with intent to endanger the passage of a locomotive and occasion the death of three persons."

Letter Ballot on Materials

The revised material specifications proposed by the Association of American Railroads, Mechanical Division, committee on this subject, was submitted to the members of the division in a letter ballot, the results of which have just been made available. The recommendations were divided into 41 separate propositions, all of which were approved and will be included in the Manual of Standard and Recommended Practice.

The first proposition pertained to the issuance and numbering of material specifications and the second to the elimination of nine separate specifications, as recommended by the committee, for such materials as steel axles, shafts, bolts and nuts, cylinder parts, fire hose, engine-bolt iron,

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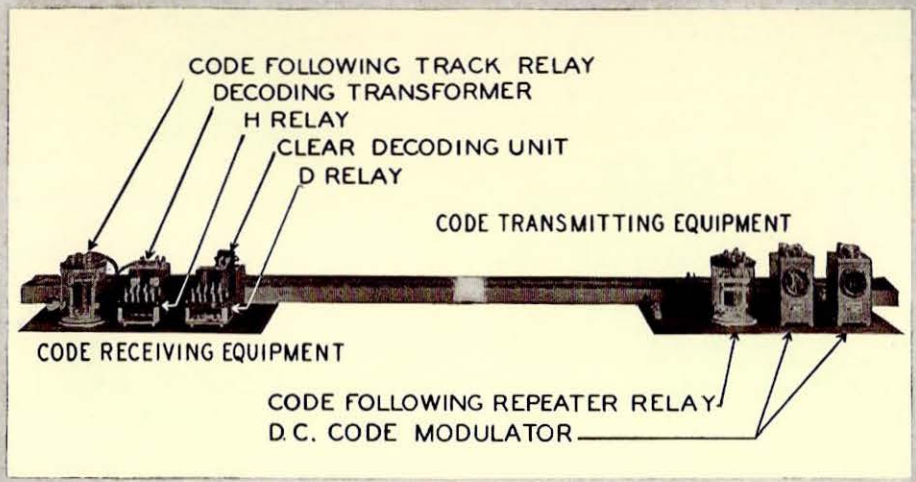

New "Union" Signaling Achievements

Coded Track Circuit Control

A new "Union" development of interrupting the track circuit current through Coding Apparatus and controlling wayside signals directly by means of this coded track circuit current without the use of line signal control wires, is the latest contribution to the art of signaling. » » » » » » »

The system may be used for controlling wayside signals only, or both wayside and cab signals may be worked in conjunction. It may be applied in either steam or electric propulsion territory. It may be employed for two-block, three-indication signaling or three-block, four-indication signaling. It can also be used where the track circuit energy is direct current, alternating current or a combination of both. » » » » » » » » »

Service tests have proved the following advantages: Increased safety of operation; foreign current protection; relay protection; greater track circuit shunting sensitivity; elimination of line wire and lower cost of providing cut sections.

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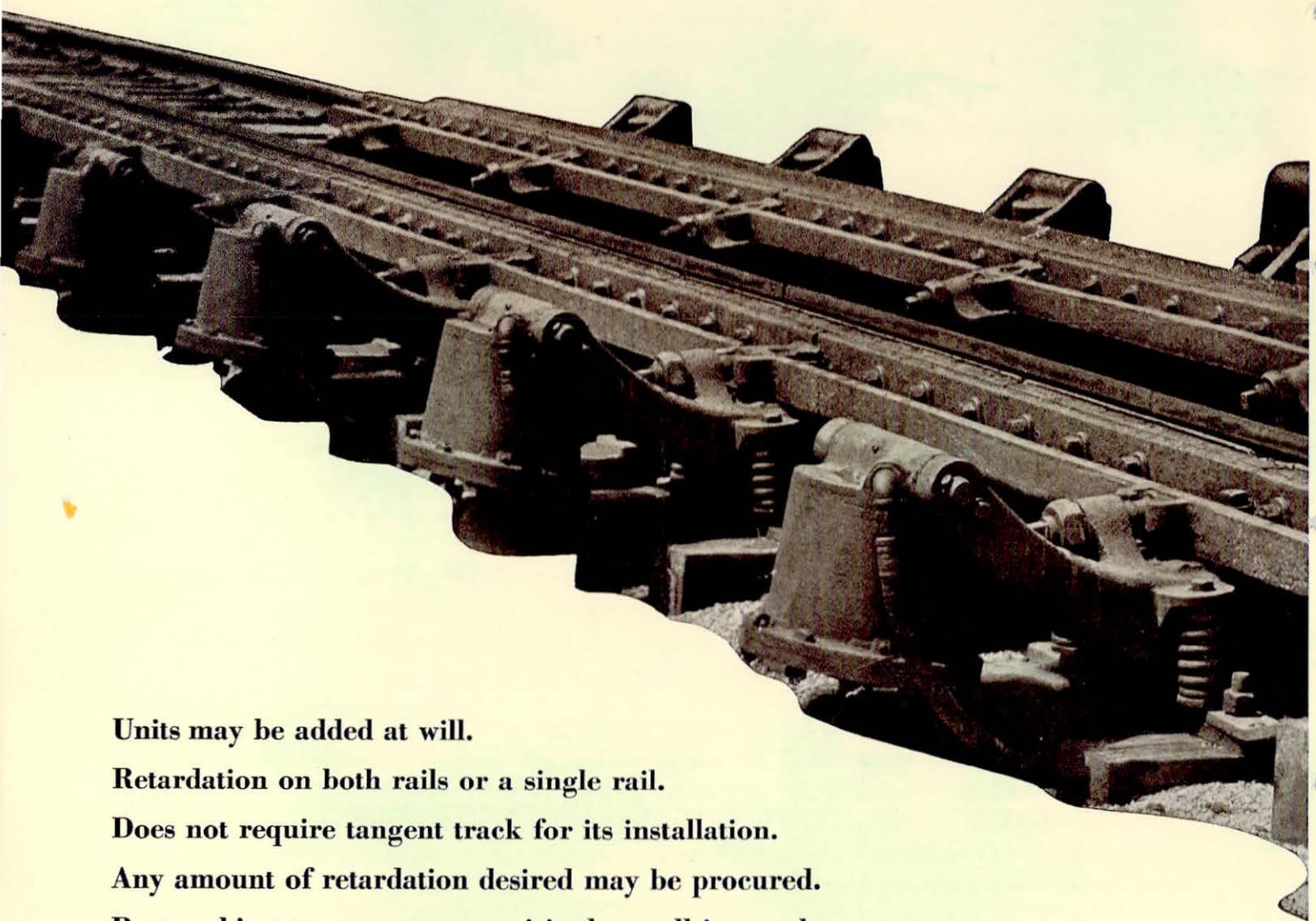

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Retardation on both rails or a single rail.

Does not require tangent track for its installation.

Any amount of retardation desired may be procured.

Parts subject to wear are surprisingly small in number.

Unit system of construction makes possible any length retarder.

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CAR RETARDER

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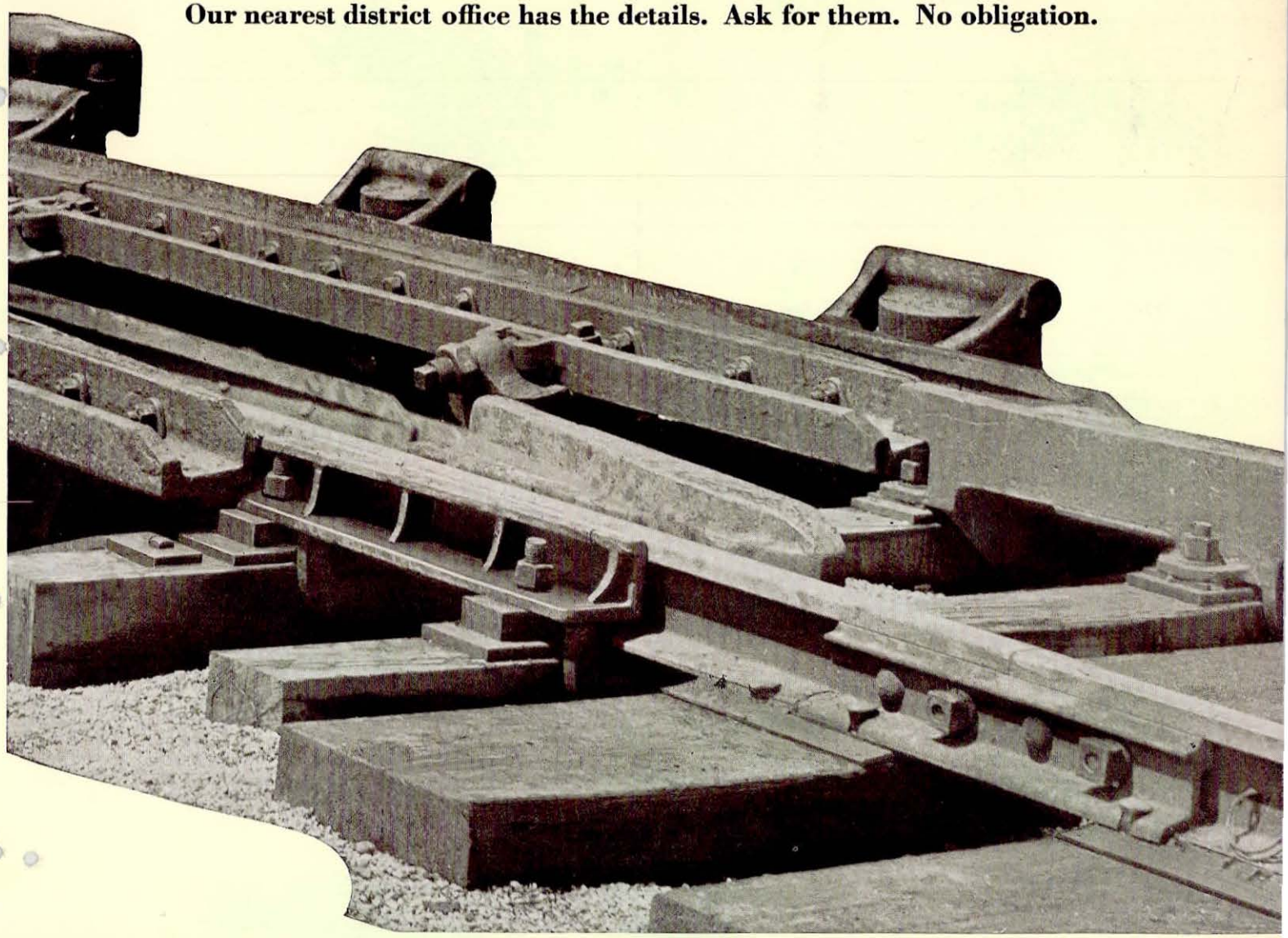

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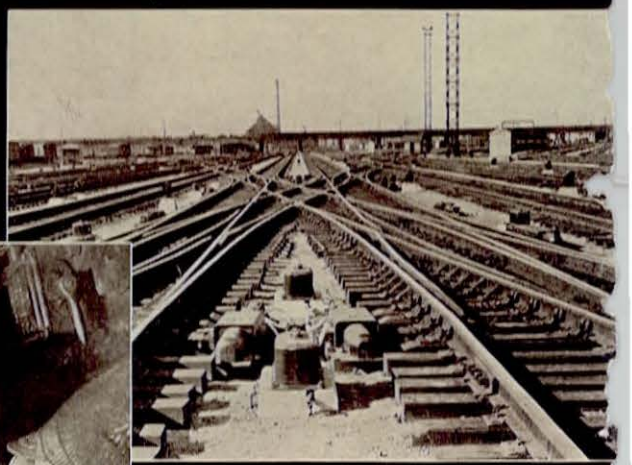

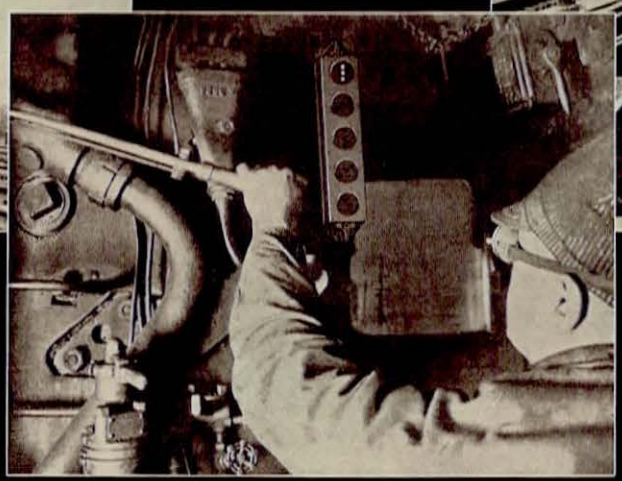

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"UNION" CENTRALIZED TRAFFIC CONTROL

provides for train operation by signal indications which take the place of written train orders and supersede time table superiority of trains. This system affords an efficient and economical method of directing train movements. It practically doubles existing traffic capacity thus postponing construction of additional trackage. C. T. C. is based upon long established, safe signaling practices.

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"UNION" POWER INTERLOCKINGS

have achieved many years of economic accomplishments. The popularity of these systems is evidenced by their use at most of the large terminals in this country and throughout the world. They have reduced maintenance labor costs to the minimum and proved economical at large terminals as well as at the small remote locations.

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foundry pig iron, axle light belting, welding wire, etc. In the Type-E coupler specifications, the part covering material was ordered removed and specifications for carbon steel castings substituted as recommended by the committee. Further propositions pertained to the adoption of revised specifications for carbon steel car axles, forgings, billets, tires, boiler tubes, boiler steel, steel structural shapes, carbon steel castings, springs, chain, bronze bearings, air-brake and signal hose, steam and hot water hose, rubber goods, etc.

Railroad Employment Increased in 1934

The average number of employees of Class I railroads for 1934, excluding switching and terminal companies, was 1,008,995, according to a compilation issued by the Interstate Commerce Commission on the basis of the twelve monthly counts. This compares with 970,893 in 1933 and 1,031,914 in 1932. Including switching and terminal companies the average for 1934 was 1,025,155, as compared with 986,573 in 1933 and 1,048,568 in 1932, and the total compensation was $1,544,219,621, as compared with $1,427,293,251 in 1933 and $1,535,927,792 in 1932. These figures represent the number of employees as of the middle of the month. The average number of employees who received some pay during the month increased from 1,086,595 in 1933 to 1,119,678 in 1934, or 3.04 per cent.

Employee Representation Dispute Taken to Court

The Shopmen's Association of the Atlantic Coast Line on March 12 applied to the supreme court of the District of Columbia for an injunction to restrain the National Mediation Board from conducting a new election to determine the representatives of the shop employees of the A. C. L. in accordance with the requirements of the railway labor act. An election was held in September which resulted in a vote in favor of the "company union" but protests were filed by representatives of the crafts affiliated with the American Federation of Labor and after a hearing the board held that the election had not been properly conducted.

The mediation board has ordered a hearing to be held at Boston on March 18 on a somewhat similar dispute arising on the Boston & Maine.

Report on Derailment at Linden, Ohio

W. J. Patterson, director of the Bureau of Safety, Interstate Commerce Commission, reporting on the derailment of a passenger train on the Pennsylvania, at Linden, Ohio, on December 27, when three employees were killed and 12 persons injured, calls attention to a "need of additional protection," at a location where boys tampered with a switch so as to derail a fast moving train; and the officers of the railroad, and local authorities, are called upon to give immediate consideration to this problem, that the lives of railroad employees and the traveling public be not unnecessarily placed in jeopardy.

Southbound passenger train No. 614, moving at full speed, ran over a misplaced switch, and the locomotive was overturned. All four cars of the train ran off the track and four freight cars on a siding were destroyed. The employees killed were the engineman, the fireman and a road foreman of engines who was riding on the locomotive. The accident occurred at 11:58 a.m., when the sun was shining brightly, but the switch lamp reflector, not much above the level of the rail, which ought to have served as a target warning the approaching engineman, had been removed from the lamp. The lenses of the lamp and other parts were missing, and the switch had been locked in position for the side track. There had been previous cases of tampering with the track and fixtures in this vicinity, but no information has developed as to the culprits.

Bill Proposes Rates Based on Cost

Representative Hamilton Fish, Jr., of New York, has introduced in Congress, by request, a bill, H.R. 6539, to amend Section 15a of the interstate commerce act by adding provisions that "in the exercise of its power to prescribe just and reasonable rates the commission shall use only a scientific method of rate determination known as 'Price Engineering,'" and that "the commission shall also use only 'Price Engineering' for the determination of rates for all other forms of transportation that may come under its jurisdiction." The bill does not say what "Price Engineering" is but a statement issued by Mr. Fish explains that it would "amend the price fixing power of the Interstate Commerce Commission from the crude, obsolete and cumbersome methods of the past to exact cost of service," and that this "new" rate method is devised to simplify the whole transportation system and enable the railroads to make a reasonable profit from their operations and secure better freight and passenger service." The bill fails to repeal, however, the provision in the present Section 15a directing the commission, in rate-making, to "give due consideration, among other factors, to the effect of rates on the movement of traffic."

Mr. Fish in his statement says the bill has for its purpose the saving of the railroads from government ownership and "to stop the trend toward demoralization and bankruptcy," and that he was introducing it to bring the problems of the railroads to the attention of the public.

Railroad's Coal Tariffs Sustained; I.C.C. Order Enjoined

On November 22, 1932, the C. M. St. P. & Pacific filed with the Interstate Commerce Commission a tariff for the transportation of bituminous coal from mines in Indiana to destinations in northern Illinois. Upon complaint by competing railroads and producers in Illinois, the Commissions suspended the proposed tariffs and afterwards annulled them. 197 I. C. C. 245,200 I. C. C. 609. A District Court of three judges perpetually enjoined the enforcement of the Commission's order, thereby reinstating the tariffs established by the carrier. 8 Fed. Supp. 970. On appeal the Supreme Court of the United States has now affirmed this decree.

The Supreme Court holds that the fact that the reduced rates, if put into effect would, as stated in the Commission's report, disrupt the rate structure in Indiana and related areas and disturb groupings and differentials established for many years did not justify the Commission in taking from the carrier the privilege of reaching out for a larger share of the business of transportation and initiating its own schedule to help it in the struggle.

The Commission's report, it was held, did not state with sufficient simplicity and clearness that it looked beyond this effect to any opinion that the new schedule would enable the railroad to get an undue proportion of the traffic, and the court is not required to choose between conflicting inferences. U. S., I. C. C. et al. v. C. M. St. P. & P.—Decided March 4, 1935. Opinion by W. Justice Cardozo.

Recommends Fourth Section Relief on Western Sugar Rates

Examiner Chester E. Stiles, of the Interstate Commerce Commission, has recommended in a proposed report that the commission grant fourth section relief asked by the railroads to authorize them to establish, subject to certain conditions, lower rates on sugar from certain California points and certain points in western trunk line and intermountain territories to Chicago, St. Louis, and certain adjacent territory, and from points in western trunk line and intermountain territory to Memphis, Tenn., Helena, Ark., and intermediate points in southern territory, than to intermediate points. The applications were predicated on water competition via the Panama canal and via barge, barge-and-lake, and barge-and-rail routes. The report shows that, from San Francisco Bay points, while water lines in 1929 carried about 25 per cent of the sugar traffic, in 1933 their proportion had increased to nearly 81 per cent. The California application had sought authority to reduce the terminal rate from time to time as rates via the competing water routes are reduced, subject to ultimate minimum rates of 48 cents, minimum 80,000 lb., and 53 cents, minimum, 60,000 lb. The examiner says that the desirability of such flexibility is evident but he recommends minimum rates of 50 and 55 cents and a requirement that the railroad tariffs making any such reductions shall be accompanied by a detailed memorandum showing the basis of the proposed reduced rates and setting forth the factors of water-line rates upon which they are based.

New York-Philadelphia Express Rates Reduced

What are described in a Railway Express Agency statement as "sweeping reductions in express rates between New York and Philadelphia, Pa., and intermediate points," became effective on March 15.

"With comparitively few exceptions," the announcement issued by Vice-President C. R. Graham read, "the new rates will be applied on practically all types of commodities, large or small. An unusual feature of the tariff, in which the new rates are detailed, is that additional reductions will be made on heavier shipments.

"Sixty-two cities and communities lo-

cated on the main lines of railroads operating between New York and Philadelphia will have the advantage of greatly lowered express rates on shipments moving between them. These include three boroughs of New York, Long Island City, Hoboken, N. J., Jersey City, Newark, Elizabeth, New Brunswick, Trenton, Philadelphia, Pa., and Camden, N. J.

"The new rates will be graduated in eight groups from one to one hundred lb., with further reductions on 101 to 500 lb. and over. Four rate bases are provided, based on distance between point of origin and shipping point. Under these schedules, the rates for shipments between New York and Philadelphia, for example, will range from 1 to 5 lb. for 25 cents to 76 to 100 lb. for 75 cents. From 101 to 250 pounds will be handled by express at 70 cents per 100 lb., 251 to 500 for 65 cents per 100 lb.; and over 500 pounds at 60 cents per 100 lb. The regular express service will be provided, including pick-up and delivery and fast movement by passenger train."

Lehigh Valley Health Insurance

Six thousand employees of the Lehigh Valley now participate in a program of health and non-occupational accident insurance which has been arranged by the road with the Metropolitan Life Insurance Company. The benefits are varied according to the employees' earnings, ranging from $5 to $25. The insurance covers all cases of sickness and cases of injury occurring when the employee is off duty. Included also are free visiting nurse service and distribution of instructive pamphlets by the insurance company. Employees of the Lehigh Valley already have group life insurance.

Government Report on Dangers of Arch-Bar Trucks

The Interstate Commerce Commission, speaking through its Bureau of Safety, W. J. Patterson, director, recommends to all railroads that steps be taken at once to inaugurate a program which will definitely eliminate the use of arch-bar trucks from service.

This recommendation is issued in connection with a report on the derailment of a passenger train on the Southern, at Charlotte, N. C., on January 13, when two persons were killed and eight were injured. Warnings of the necessity of eliminating arch-bar trucks have been given in connection with a number of accident reports lately, mention being made, in each case, of the rule adopted by the American Railway Association (now Association of American Railroads) that these trucks should not be offered in interchange after a certain date (this date has been repeatedly postponed and lately has been changed from January 1, 1936, to January 1, 1938). The present report, however, is predicated on the failure of such a truck on a tender; and the operation of tenders is not affected by the interchange rules. On the Southern, it was found that of 1,932 tender trucks in service, 1,307 were of the arch-bar type. Of these, 265 were in passenger service.

The accident now reported occurred on the Charlotte division, between Salisbury, N. C., and Charlotte. Southbound passenger train No. 31, moving at about 50 miles an hour, was derailed on a curve of 6 deg.; superelevation 2¾ in. The locomotive was overturned and one car fell down a bank into a street, demolishing one corner of a brick hotel. Of several breaks in the arch-bars (one truck being under the tender and one under a baggage car) all were apparently new, with no evidence of old flaws or cracks. The trucks had been repaired, but there was no precise information as to what in them was new material. The track on this curve was not well-maintained, the elevation and the gage both being uneven, but the conclusion is that the failure of a truck was the main cause.

Speedy Action Urged on Transportation Legislation

The Transportation and Communication Department Committee of the Chamber of Commerce of the United States has submitted a report to the board of directors urging action without fail at this session of Congress on the pending water and motor carrier bills, saying that the public interest, as well as that of the transportation agencies, has suffered because of the long delay in settling the questions covered by these bills. Belief is expressed, however, that this can best be obtained by separate measures for rail, bus, truck, water, and air transportation, in order that difficulties in working out the form of legislation may not interfere with adoption of that for the other classes.

The committee believes the Interstate Commerce Commission to be the proper agency to administer transportation regulation. It suggests separate divisions of the commission for the principal branches of transportation but proposes that the law leave the details of organization to be decided by the commission. The federal co-ordinator of transportation would have the law prescribe the organization of the commission in detail. The commission, on the other hand, recommends that it be allowed to effect its own reorganization. The chamber's committee accepts in part the views of each of these authorities.

The chamber committee recognizes the value of codes of fair competition as a supplement to commission regulation, particularly with regard to such matters as wages and hours. It proposes temporary continuation of a limited code system in appropriate cases, code requirements to be subject to review by the regulatory body. The administrative work of the commission the committee would place in a series of divisions under the reorganized commission, each dealing with the same type of question for all transportation agencies and serving the different branches of the commission.

The committee also holds that emergency powers in the co-ordinator to issue orders requiring the railroads to put into effect plans worked out by his organization are unnecessary.

An analysis of the costs to the general public of improving and maintaining inland waterways demonstrates that on a considerable percentage of the country's waterways the cost per ten-mile of traffic is high enough to call for special scrutiny as to its economic justification, the committee says in a special report made after study of 97 principal waterways or sections of waterways. Considering the average railroad freight rate of one cent per ton-mile, and taking into account the lower grade of commodities generally handled by water as well as the longer distances by waterways, the committee concludes that the rate for waterway traffic (or the cost to a private operator) must ordinarily be less than ½ cent per ton-mile to attract shippers. To justify a given waterway project, the committee holds that the combined cost of improvement and maintenance plus the cost of handling its traffic should generally not exceed that figure per ton-mile. It is recognized that special conditions may justify higher costs, as, for example, when no other form of transportation is available or where improvement of relatively short waterways opens up new traffic. The committee does not give figures for or express opinion as to the value of individual waterways.

Trainmen Threaten Mediation Board

A strongly-worded protest denouncing the decisions of the National Railway Mediation Board was telegraphed to that body in Washington on March 10, following a meeting of 70 national and local officers of the Brotherhood of Railroad Trainmen at Chicago. The protest included a threat that the union would call a strike of railroad employees if the board continued in its "inconsistent and unjustifiable decisions." This threat was made despite the fact that the Railway Labor Act provides that railroad employees may not strike without first submitting their controversy to mediators and to arbitration. The brotherhood officers complain that the board, in ordering a vote on the question of who shall represent the employees in their dealings with the railroad companies, has directed that yard foremen and yard helpers vote as separate groups. The union maintains that such a division upsets precedents of 20 years and imperils the unity of the employees in their dealings with the companies.

The Order of Railway Conductors, which formerly admitted only passenger and freight conductors, last year amended its by-laws to permit other railroad employees to become members. Since that time the conductors' union has been active in soliciting members of the Brotherhood of Railroad Trainmen to join the conductors. The conductors' union has asked the Mediation Board to hold a vote of the yard crews of the Indiana Harbor Belt to determine which union shall represent them.

The message sent to the board by A. F. Whitney, president of the trainmen's brotherhood, said in part: "Chicago yard men will positively refuse to participate in any vote on the representation question which comprehends splitting yard forces, and this brotherhood proposes to place responsibility where it belongs. Your board is advised that any decision on its part to separate yard foremen, helpers, car retarder operators and switchtenders on any vote taken on the Indiana Harbor Belt, or any other line, will be construed as an official signal for the men involved to leave the service."

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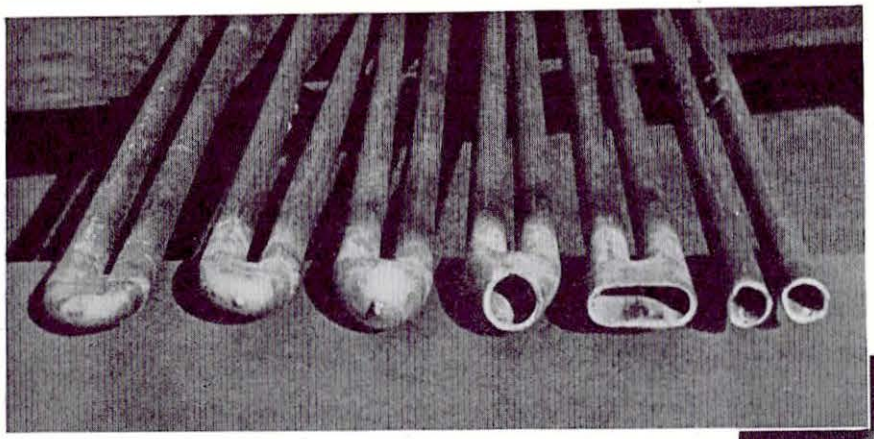
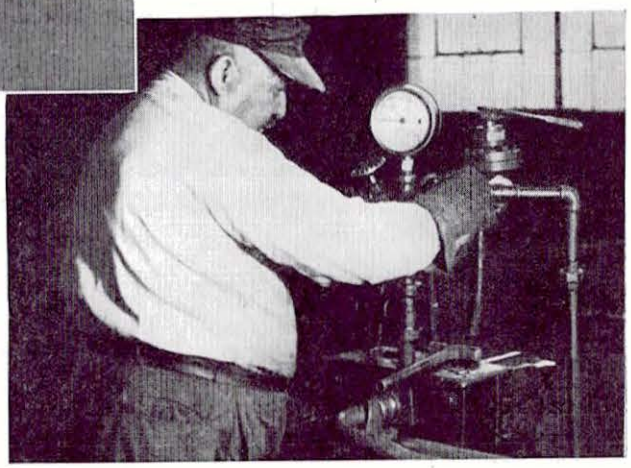


The ends of sound tubing are die-forged to form new return bends. This process provides an absolute control of the internal and external areas of the return bends. There are no joints with internal ridges and poor wall structures — each return bend is an integral part of the tubing itself.



Each and every REmanufactured superheater unit is tested under a hydrostatic pressure of 2500 lb.

REmanufactured Superheater Units

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BECAUSE in REmanufacturing unserviceable superheater units, all defective material is discarded, and the units are built-up only from sound, carefully inspected and tested tubing — reforged, rigidly tested — REmanufactured superheater units are assurance against defects.

For many years they will give troublefree service — there will be no delays of trains caused by superheater failures. Likewise, superheater maintenance in the roundhouse will be negligible.

You can free your road from these troubles only by having unserviceable superheater units properly rebuilt. Standardize on the Elesco unit REmanufacture service.

Send for our descriptive literature on this process — no obligation.

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Representative of AMERICAN THROTTLE COMPANY, Inc.

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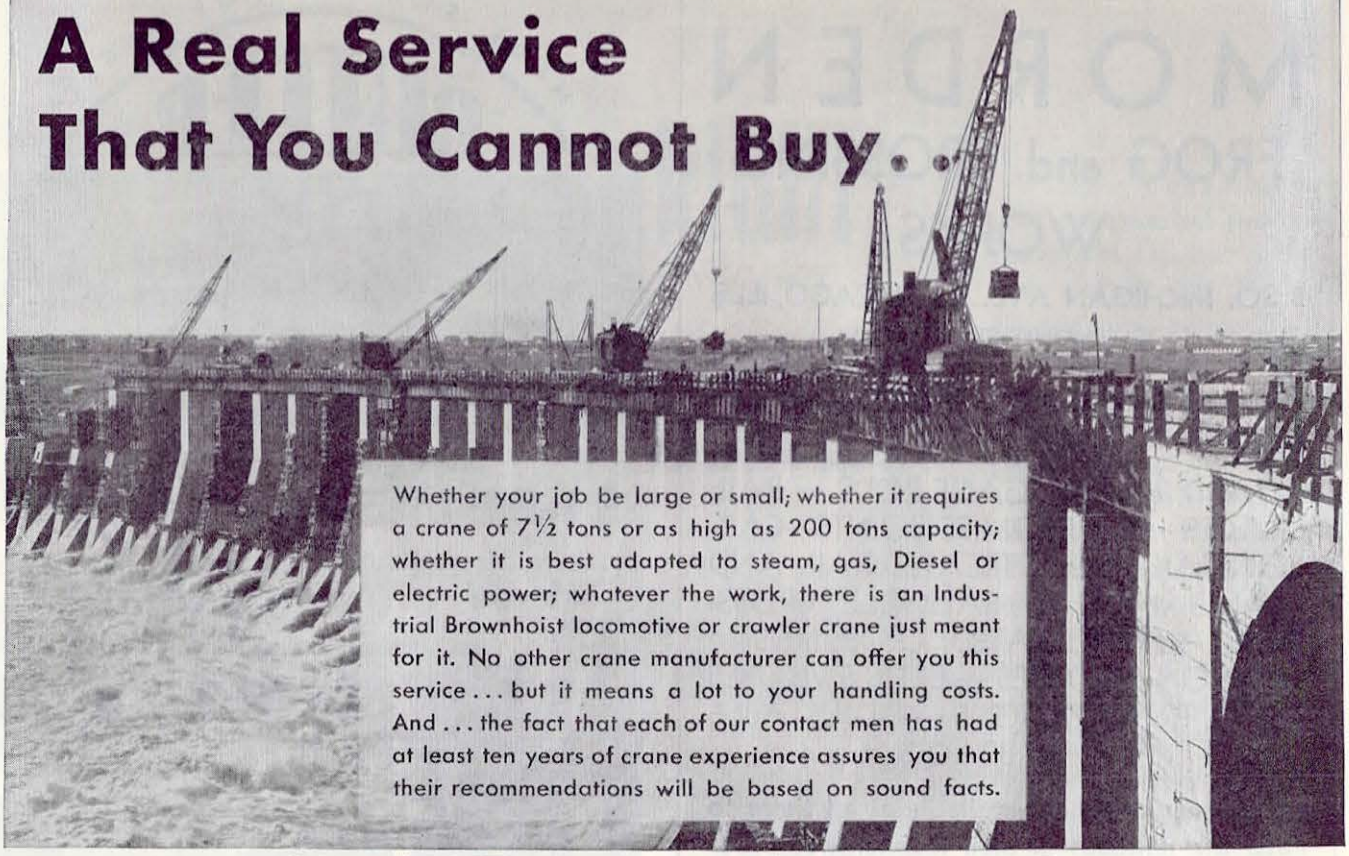
Superheaters - Feed Water Heaters - Exhaust Steam Injectors - Superheated Steam Pyrometers - American Throttles

A Real Service That You Cannot Buy. . .



Whether your job be large or small; whether it requires a crane of 7½ tons or as high as 200 tons capacity; whether it is best adapted to steam, gas, Diesel or electric power; whatever the work, there is an Industrial Brownhoist locomotive or crawler crane just meant for it. No other crane manufacturer can offer you this service . . . but it means a lot to your handling costs. And . . . the fact that each of our contact men has had at least ten years of crane experience assures you that their recommendations will be based on sound facts.

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When you put your money into KERITE you make an investment in service. You do more than buy conductors, insulation and protection. You obtain the best possible combination of the most desirable qualities in permanent form. KERITE remains long after the price is forgotten.

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NEW YORK CHICAGO SAN FRANCISCO

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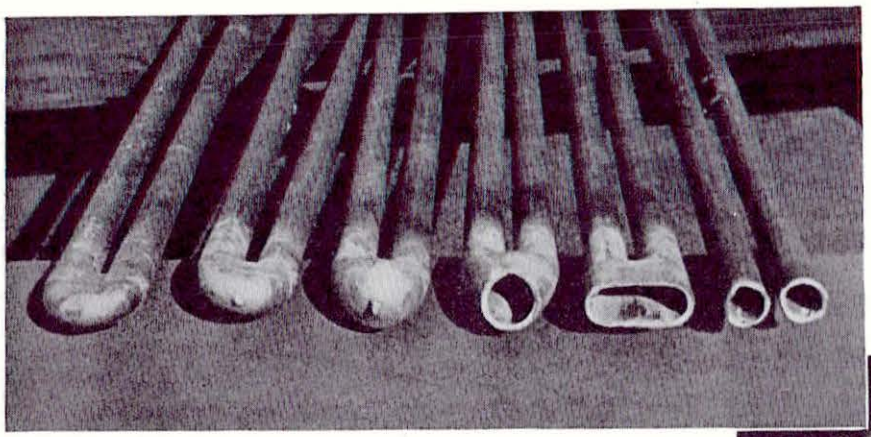
SCIENCE AND INVENTION HAVE NEVER FOUND A SATISFACTORY SUBSTITUTE FOR GENUINE PUDDLED WROUGHT IRON



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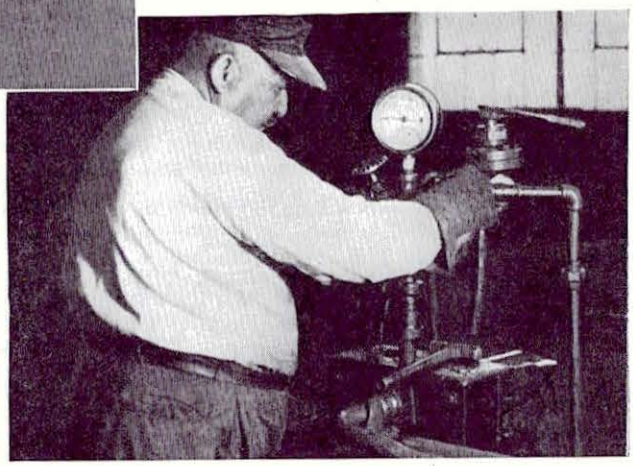

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Peoples Gas Building
CHICAGO

Canada: The Superheater Company, Limited, Montreal

Superheaters - Feed Water Heaters - Exhaust Steam Injectors - Superheated Steam Pyrometers - American Throttles

Equipment and Supplies

LOCOMOTIVES

THE WHEELING & LAKE ERIE will build eight 0-6-0 switching locomotives in its shops at Brewster, Ohio.

THE RUSSIAN GOVERNMENT is inquiring through the Amtorg Trading Corporation, New York, for some eight-wheel switching locomotives.

FREIGHT CARS

THE CHESAPEAKE & OHIO is inquiring for materials to repair freight cars.

THE PERE MARQUETTE is inquiring for materials to repair freight cars.

THE UNITED STATES ENGINEER OFFICE, Rock Island, Ill., is asking for bids March 29 for one flat car.

IRON AND STEEL

THE KANSAS CITY SOUTHERN is inquiring for 2,000 tons of rails.

THE UNION PACIFIC is expected to enter the market for 19,000 tons of rails and 5,000 tons of fastenings.

THE CHICAGO & NORTH WESTERN will enter the market soon for 25,000 tons of rail and 8,000 tons of fastenings.

THE GULF MOBILE & NORTHERN has ordered 3,218 tons of rails and 700 tons of accessories from the Tennessee Coal, Iron & Railroad Company.

THE VIRGINIAN has placed an order with the Bethlehem Steel Company for 2,200 tons of rail, for delivery during April and May.

LONG ISLAND.—A contract for 1,500 tons of steel has been let to the Jones & Laughlin Steel Corporation and a contract to erect the steel has been given to the National Bridge Works by the Faircroft Engineering Corporation, Brooklyn, N. Y., who has the contract for grade crossing elimination work on this road at St. Albans and Springfield, N. Y.

NEW YORK CENTRAL.—Inquiries are being made for 500 tons of steel for grade crossing elimination work at Utica, N. Y. A contract for 1200 tons of steel for the West Side Improvements between Fifty-fourth and Sixty-fourth streets, New York City, was let to the American Bridge Company. Other contracts for steel on this work were reported in the *Railway Age* of February 16.

THE NEW YORK CENTRAL LINES have placed contracts for approximately 20,000 tons of new rail and angle bars for use during 1935, aggregating $1,042,000, the purchase was divided among the Bethlehem Steel Company, the Illinois Steel Company and the Algoma Steel Corporation. Contracts were also placed for the necessary track fastenings and accessories for new rail and maintenance amounting to approximately $686,583. The purchase was divided among the following companies: The American Fork & Hoe Company, the Bethlehem Steel Company, the Cleveland Frog & Crossing Company, the Creepcheck Company, the Illinois Malleable Iron Company, Illinois Steel Company, the Inland Steel Company, the Jones & Laughlin Steel Corporation, the Lorain Steel Company, the P. & M. Company, the Positive Rail Anchor Company, the Rail Joint Company, the Ramapo Ajax Corporation, the Republic Steel Corporation, the Weirton Steel Company, William Wharton, Jr. & Company, Inc., the Wheeling Steel Corporation, the Woodings Forge & Tool Company, and the Youngstown Sheet & Tube Company.

AIR CONDITIONING

THE CHICAGO, ROCK ISLAND & PACIFIC has ordered one set of American Car & Foundry Company's modified thermo gravity air-conditioning system of seven tons' capacity, for installation in a parlor car.

THE PULLMAN-STANDARD CAR MANUFACTURING COMPANY has received orders for the installation of air conditioning equipment from the following companies: Chesapeake & Ohio in 14 coaches; New York, Chicago & St. Louis in one coach, and Seaboard Air Line in 5 coaches.

THE NORFOLK & WESTERN will spend approximately $80,000 for the air-conditioning of eight additional units of its standard passenger equipment, the work to be done by the railroad's employees in its Roanoke, Va., shops. The project calls for the air conditioning and remodeling of four standard passenger coaches and the air conditioning of four dining cars. In addition to air conditioning, the remodeling of the four coaches will include the construction of new arched ceilings, the installation of dome lights, laying of new rubber tile floors and repainting the interior of the cars. The company was reported in the *Railway Age* of February 2 as having started similar work costing $80,000 on the air conditioning and remodeling of eight passenger coaches. Work on the new job will be carried on concurrently with the cars now being air conditioned in the local shops and it is expected that all 16 units will be placed in service in June. The completion of this work will give the Norfolk & Western 62 air-conditioned units of passenger equipment; these include 30 coaches, 11 dining cars and 21 Pullman cars.

MISCELLANEOUS

THE WESTERN MARYLAND has ordered from the Valve Pilot Corporation, New York, five Loco Valve Pilots for use on its heavy freight power.

THE PENNSYLVANIA is inquiring for bids for conveyor machinery and equipments for installation in the new postoffice annex building which is constructed over the tracks of the Pennsylvania station at New York City.

Supply Trade

C. H. Rhodes, assistant general manager of sales of the bar, semi-finished and alloy steel division of the **Illinois Steel Company,** with headquarters at Chicago, has been appointed director of purchases of the **United States Steel Corporation,** with headquarters at New York, and has been succeeded by **Griswold A. Price,** who since January 1 has been manager of sales at St. Louis, Mo., for the **Carnegie Steel Company,** the **Illinois Steel Company** and the **Tennessee Coal, Iron & Railroad Company. Robert Corson, Jr.,** succeeds Mr. Price at St. Louis. **William B. Weston,** manager of sales in the Detroit district for the Carnegie Steel Company, the Illinois Steel Company and the Tennessee Coal, Iron & Railroad Company, has been appointed assistant to the vice-president and general manager of sales of the Carnegie Steel Company, with headquarters at Pittsburgh, Pa., and has been succeeded by **Philip M. Guba,** assistant manager, at Detroit, Mich.

W. R. Walsh, who has been elected vice-president of the **Ewald Iron Company,** with headquarters at Chicago, after attending the University of Illinois, began his business career in 1917 as an office and sales department employee of the Standard Oil Company. He entered the railway

W. R. Walsh

supply business in 1920 and for several years represented the Glidden Company and several other railway supply companies. In 1926 he was appointed representative of the Ewald Iron Company and in 1928 was promoted to resident sales manager, which position he has held until his recent election as vice-president.

John M. Mulholand, special representative of railroad sales at Chicago, for the **Youngstown Sheet & Tube Company,** Youngstown, Ohio, has been appointed manager of railroad sales for the company. Mr. Mulholand's headquarters will continue to be at Chicago. He was born at Pittston, Pa., and after attending grammar and high schools in that state, was a member of the class of 1910, University of Michigan, marine engineering course. From 1910 to 1917 Mr. Mulholand fol-

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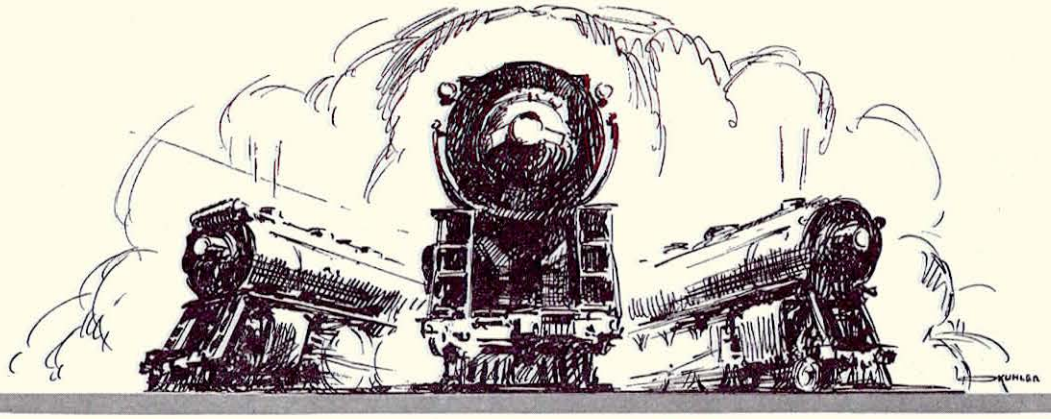

AMERICAN LOCOMOTIVE CO.

"DURING the last 15 or 20 years locomotive steam pressures have been advanced from around 200 pounds to as high as 850. Every part of the unit has come in for redesign or other improvement, with the result that the service thermal efficiency of new units is approximately double that of those built 20 years ago. Meanwhile, runs between division points have been increased from 100 or 150 miles to 500, 600, 700, even above 800 miles, and the mileage covered between overhaulings has been increased around 10 times, so that today many passenger locomotives go 300,000 miles without a general shopping.

Accordingly, though I repeat that we are equipped, and it is our job, to give our customers whichever power unit is for them most economic, all things considered, I judge that the steam locomotive is a long way from done for; may well increase the respect and affection railroad men have for it; will gain, rather than lose, from the competition of the new main-line unit, the oil-electric."

By William C. Dickerman
In Scientific American

30 CHURCH ST. NEW YORK N.Y.

lowed engineering, principally mining work, and then served in the war, entering the service through the Officers Training School Tank Corps. From the close of the war to 1932 he was actively en-

John M. Mulholand

gaged in the railroad equipment field, first as district sales manager of Mudge & Company, and then as vice-president of sales of the O. F. Jordan Company. Mr. Mulholand has been with the Youngstown Sheet & Tube Company since December, 1932.

OBITUARY

Ralph H. Clore, general sales manager of The Medart Company, St. Louis, Mo., died on March 6.

William L. Reid, vice-president of the Lima Locomotive Works, Inc., died suddenly, on March 9 at Lima, Ohio. Mr. Reid was a native of Paterson, N. J., and was well known in railroad circles. He started his career as an apprentice in the

William L. Reid

old Rogers Locomotive Works at Paterson, N. J. In 1901 he became general works manager of the American Locomotive Company. In 1918 he was elected vice-president in charge of manufacturing of the Lima Locomotive Works, Inc. Mr. Reid spent his entire business life in locomotive development and was an active member of the American Railway Master Mechanics Association.

Financial

ATLANTIC COAST LINE.—*Bonds.*—The Interstate Commerce Commission has authorized this company to issue $12,000,000 of general unified mortgage 50-year, series A, 4½ per cent bonds, maturing in 1964. The issue is authorized for sale to Brown, Harriman & Co., and Edward B. Smith & Co., New York, at 87¼, making the annual interest cost to the railroad approximately 5.73 per cent. The Commission considered the question of requiring the establishment of a sinking fund for these bonds, but certain practical difficulties arose which decided the Commission against making this requirement; it pointed out, however, that the road would have maturities of $63,353,000 in the next 18 years and that a requirement on its part that some of these be paid off at maturity without refunding would be equivalent in practical effect to a sinking fund requirement for the new issue.

BALTIMORE & OHIO.—*Abandonment.*—The Interstate Commerce Commission has authorized this company and the Toledo & Ohio Central to abandon part of a branch extending from Hamilton, Ohio, to a point west of Woodsdale Junction, 3.6 miles.

BOYNE CITY.—*Abandonment.*—This company has applied to the Interstate Commerce Commission for authority to abandon its line from Boyne Falls, Mich., to Alpena, 83.7 miles.

ERIE.—*Bond Extension.*—This company has extended to March 22 the date until which New York, Pennsylvania & Ohio 4½ per cent bonds due March 1 may be extended at 4¼ per cent until 1950. Edward B. Smith & Co. and Brown, Harriman & Co., who are offering to purchase the maturing issue at par, have also extended their offer to March 22.

GULF, MOBILE & NORTHERN.—*P. W. A. Loan.*—This company has applied to the Interstate Commerce Commission for authority for the expenditure of $212,500 for the purchase and laying of 90-pound rail on 22.5 miles of the line of the New Orleans Great Northern which it proposes to finance with a loan from the Public Works Administration.

LEHIGH & NEW ENGLAND.—*Bonds.*—This company has applied to the Interstate Commerce Commission for authority to issue and sell $6,500,000 of 30-year 4 per cent general mortgage bonds to provide for the redemption and cancellation of $6,500,000 of general mortgage 5 per cent bonds as of July 1 at a premium of 5 per cent. It is proposed to sell the bonds to Kidder, Peabody & Co., at 98. The company proposes to create a new general mortgage to secure not more than $15,000,000 of bonds and to establish a sinking fund by paying to the trustee each year only out of net income for the preceding calendar year 10 per cent of the net income to be applied to the purchase of the bonds.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—*R.F.C. Loan.*—The Interstate Commerce Commission has authorized the extension for a period of two years of loans to this company from the Reconstruction Finance Corporation totaling $1,319,553.

MOREHEAD & NORTH FORK.—*Operation.*—The Morehead & North Fork Railway Company has been authorized to acquire and operate that portion of the line of the railroad formerly owned and operated by the Morehead & North Fork Railroad Company extending from Morehead, Ky., southerly to a point near the north entrance of the Clack Mountain Tunnel, 4 miles.

PORT ANGELES WESTERN.—*R.F.C. Loan.*—This company has applied to the Reconstruction Finance Corporation for a loan of $800,000 to meet indebtedness and provide for the construction of a branch line.

ST. LOUIS-SAN FRANCISCO.—*Investigation.*—An inquiry into the financial affairs of the St. Louis-San Francisco prior to bankruptcy in 1931 was ordered shifted to New York by Federal Circuit Judge Charles B. Faris at a hearing in St. Louis on March 9. A request for the removal of the hearing, under way at St. Louis for four days before a special master, was made by John G. Lonsdale, co-trustee of the road, so that prominent bankers in the eastern cities could be more easily questioned. Judge Faris ordered that testimony start not later than March 21.

SOUTHERN PACIFIC.—*Trackage Rights.*—The Interstate Commerce Commission has authorized this company to operate under trackage rights over the Yuma Valley Railroad (owned by the federal government) between Yuma, Ariz., and Somerton, 15 miles.

TIONESTA VALLEY.—*Abandonment.*—This company has applied to the Interstate Commerce Commission for authority to abandon its line from Sheffield Junction, Pa., to Hallton, 17 miles.

TOLEDO & WESTERN.—*Abandonment.*—The Interstate Commerce Commission has authorized this company to abandon its entire line extending from Toledo, Ohio, to Adrian, Mich., 30.6 miles.

WASHINGTON & OLD DOMINION.—*Abandonment.*—The Interstate Commerce Commission has authorized the receiver of this company to abandon a part of a line between Thrifton, Va., and Great Falls, 12.1 miles.

Average Prices of Stocks and of Bonds

	Mar. 12	Last week	Last year
Average price of 20 representative railway stocks..	28.05	30.19	46.94
Average price of 20 representative railway bonds..	71.48	73.28	78.97

Dividends Declared

Alabama & Vicksburg.—$2.75, semi-annually, payable April 1 to holders of record March 8.

Beech Creek.—50c, quarterly, payable April 1 to holders of record March 15.

Old Colony.—$1.75, quarterly, payable April 1 to holders of record March 16.

Southern.—Mobile & Ohio.—$2.00, semi-annually, payable April 1 to holders of record March 15.

Vicksburg, Shreveport & Pacific.—Common, $2.00, semi-annually; Preferred, $2.50, semi-annually, both payable April 1 to holders of record March 8.

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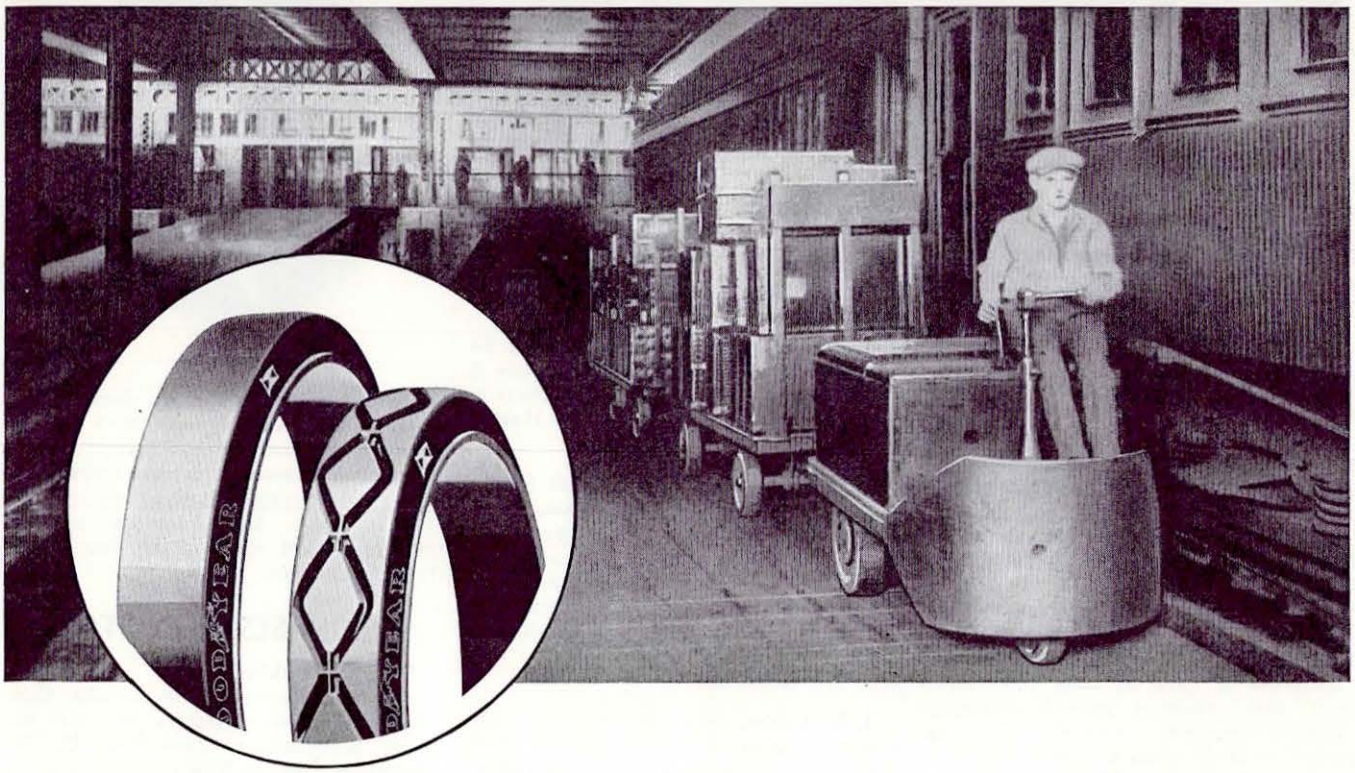
Put 'em on Goodyears_ Save money 10 ways



They're designed right. They're built right—of the right kind of rubber. That briefly explains why Goodyears are the RIGHT tires for your industrial trucks and trailers.

The right design means 53% less power to keep them rolling. The right rubber means longer, more economical service.

Put your industrial trucks and trailers on Goodyears and you get these ten money-saving advantages:

1. Easier starting
2. Lower rolling resistance
3. Greater speed
4. More trips per day
5. Less load breakage
6. Less noise
7. Less floor wear
8. Less vibration
9. Longer battery life
10. Fewer battery charges

And remember! Goodyear Industrial Truck Tires bear the greatest name in rubber. That's your assurance of the best.

THE GOODYEAR TIRE & RUBBER COMPANY, INC.
AKRON, OHIO

GOODYEAR

INDUSTRIAL TRUCK TIRES

Railway Officers

EXECUTIVE

Edward W. Scheer, vice-president in charge of operation and maintenance of the Central of New Jersey and the Reading, has also been elected to that position on the New York & Long Branch.

Edgar D. Hilleary, vice-president in charge of traffic for the Central of New Jersey and the Reading with headquarters at Philadelphia, Pa., has been appointed to the same position on the Wharton & Northern, succeeding **Arthur Hamilton,** retired.

C. L. Billings, general manager of the Washington, Idaho & Montana, with headquarters at Lewiston, Ida., has been elected also president, succeeding **F. S. Bell. R. M. Weyerhaeuser** has been elected vice-president with headquarters at Cloquet, Minn.

W. S. Bronson, whose election as vice-president and general counsel for the Pittsburgh & West Virginia was noted in the *Railway Age* of March 9, will make his headquarters at Washington, D. C., and not at Cleveland, Ohio, as reported in the previous announcement. Mr. Bronson was born on September 21, 1864, at Sandusky, Ohio, and was educated in the high schools. He entered railroad service in 1886 with the Indiana, Bloomington & Western, now Cleveland, Cincinnati, Chicago & St. Louis. From January, 1890, to March, 1929, Mr. Bronson served with the Chesapeake & Ohio as chief rate clerk, chief clerk, assistant general passenger agent, commerce counsel, assistant general counsel, general claims attorney and general attorney. He resigned to engage in the general practice of law and to enter the service of the Pittsburgh & West Virginia in March, 1929, as general attorney, the position he held until his recent election.

MECHANICAL

Howard Pyle has been appointed mechanical supervisor in charge of the mechanical department of the Maryland & Pennsylvania at Baltimore, Md., succeeding the late **C. L. Adair,** master mechanic.

William S. Eyerley, Jr., assistant superintendent of the Mount Clare shops of the Baltimore & Ohio, has been appointed superintendent of these shops, with headquarters at Baltimore, Md., succeeding the late **T. R. Stewart.**

TRAFFIC

Walter R. Parker has been appointed general agent for the Toledo, Peoria & Western at Cleveland, Ohio, succeeding **W. L. Monson.**

H. M. Larson, traveling passenger agent on the Chicago, Milwaukee, St. Paul & Pacific, at St. Paul, Minn., has been promoted to general agent at Minneapolis, succeeding **T. A. Morken,** who has been appointed city passenger agent.

Charles H. Chabot, freight representative for the Wharton & Northern, has been appointed general agent, with headquarters at Wharton, N. J., succeeding **John F. Hourigan.**

H. A. Tenney, city passenger agent for the Southern Pacific at San Antonio, Tex., has been appointed general agent, passenger department, at Houston, Tex.

Harry L. Farrell has been appointed district freight representative for the Baltimore & Ohio, with headquarters at Charlotte, N. C.

L. E. Clifton Roehrig has been appointed division freight agent for the Baltimore & Ohio, with headquarters at DuBois, Pa., succeeding **E. M. Meagher,** deceased.

Lee Metcalf, contracting freight agent on the Great Northern at Portland, Ore., has been appointed general agent at Great Falls, Mont., succeeding **J. F. Kelly,** resigned.

E. H. Yarke has been appointed division freight agent for the Baltimore & Ohio and the Alton, with headquarters at St. Louis, Mo., succeeding **W. M. Haenssel,** transferred.

H. L. Morrison, general agent for the St. Louis-San Francisco at Detroit, Mich., has been transferred to Chicago, to succeed **W. B. Wells,** who has been appointed special representative—traffic, with the same headquarters. **J. E. Henderson,** formerly general agent at Detroit, has been reappointed to that position to succeed Mr. Morrison.

J. E. Capps, chief clerk to the freight traffic manager of the Chicago, Rock Island & Pacific, has been promoted to assistant general freight agent, with headquarters as before at Chicago, succeeding **C. R. Maier. J. Sander,** chief clerk to the assistant freight traffic manager, at Chicago, has been appointed to the newly-created position of assistant general freight agent, with the same headquarters.

Ashley Poynor, foreign freight agent of the Missouri Pacific at St. Louis, Mo., has been appointed assistant general freight agent, with the same headquarters. **L. L. Smith** has been appointed general agent at San Francisco, Cal., succeeding **W. M. Cook,** whose appointment as assistant traffic manager at San Francisco was noted in the *Railway Age* for February 23. **M. P. Eckman** has been appointed general agent at Hutchinson, Kan., to succeed **C. M. Davis.**

J. R. Shannon, general freight agent of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., has been appointed assistant to the traffic manager, with headquarters at San Francisco, Cal. **Herbert W. Ward** has been appointed general freight agent in charge of solicitation, with headquarters at Minneapolis, to succeed Mr. Shannon. **C. L. Fuller,** traveling agent at Cincinnati, Ohio, has been appointed general agent at Indianapolis, Ind., succeeding **A. M. McIntyre,** who has been transferred to Chicago.

A. B. Craig, whose appointment as general freight agent for the Central of New Jersey at New York was noted in the *Railway Age* of March 9, served with the Adams Express Company from June, 1902, to March, 1907. He entered the service of the Central of New Jersey in March, 1907,

A. B. Craig

as a waybill clerk. Since then he has served successively as chief clerk to general eastern and foreign freight agent; chief clerk to assistant freight traffic manager; traffic representative and division freight agent. Mr. Craig was assistant general freight agent at the time of his recent promotion.

PURCHASES AND STORES

T. M. Hawkins, master mechanic for the Quebec Central at Sherbrooke, Que., has been appointed storekeeper, with the same headquarters, succeeding **G. H. Mulvagh,** who has been transferred to the general office staff. The position of master mechanic has been abolished.

OBITUARY

Elmer Irving, engineer maintenance of way of the eastern region of the Pennsylvania at Philadelphia, Pa., died on March 13 in the Jefferson Hospital, Philadelphia, after a short illness. Mr. Irving was 57 years old; death was caused by asthma and heart disease.

Frank C. Reardon, superintendent of stores for the Delaware & Hudson with headquarters at Colonie, N. Y., died at his home in Albany, N. Y., on March 9. Mr. Reardon entered the service of the Delaware & Hudson as flagman in the maintenance of way department at Fort Edward, N. Y., in January, 1891. In October, 1891, he became supervising clerk in the maintenance of way department, Saratoga division, and served in various other clerical capacities in that department until December, 1910. Mr. Reardon was then promoted to chief clerk in the transportation department, Saratoga division, becoming inspector of stores in the stores department at Colonie in 1913. In 1917 he was promoted to superintendent of stores at Colonie, serving in that position until his death.

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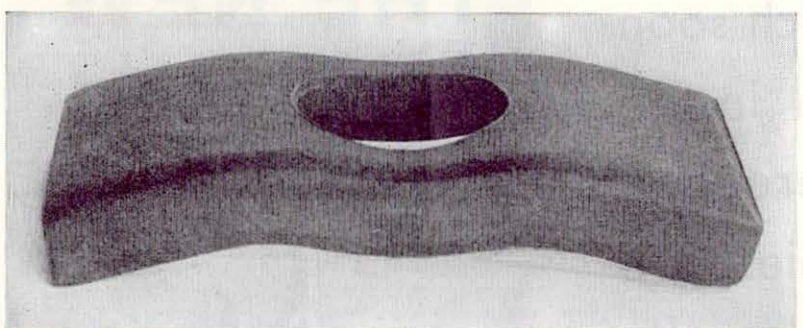

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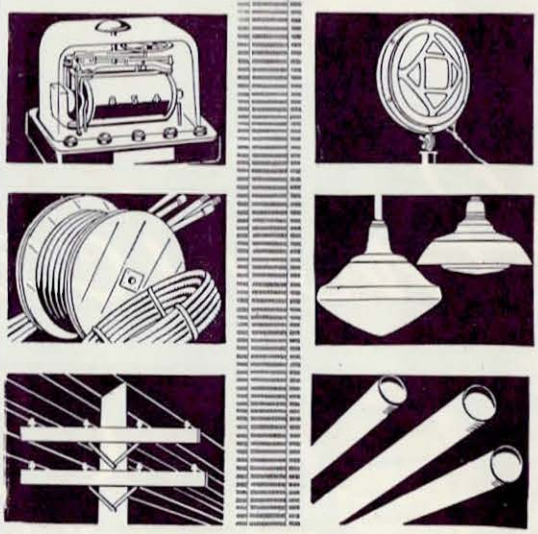

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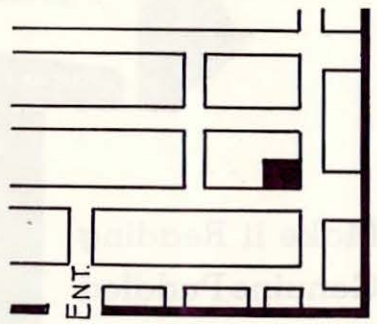

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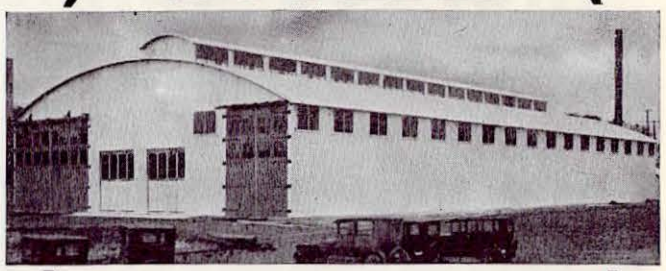

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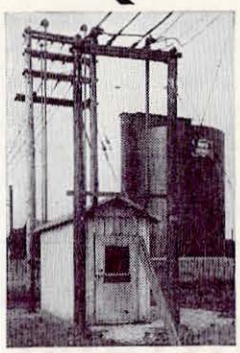
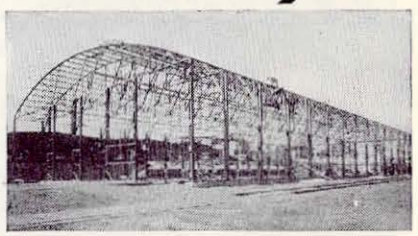

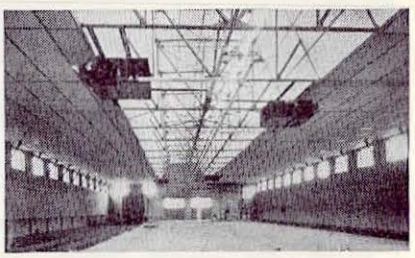
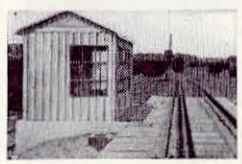

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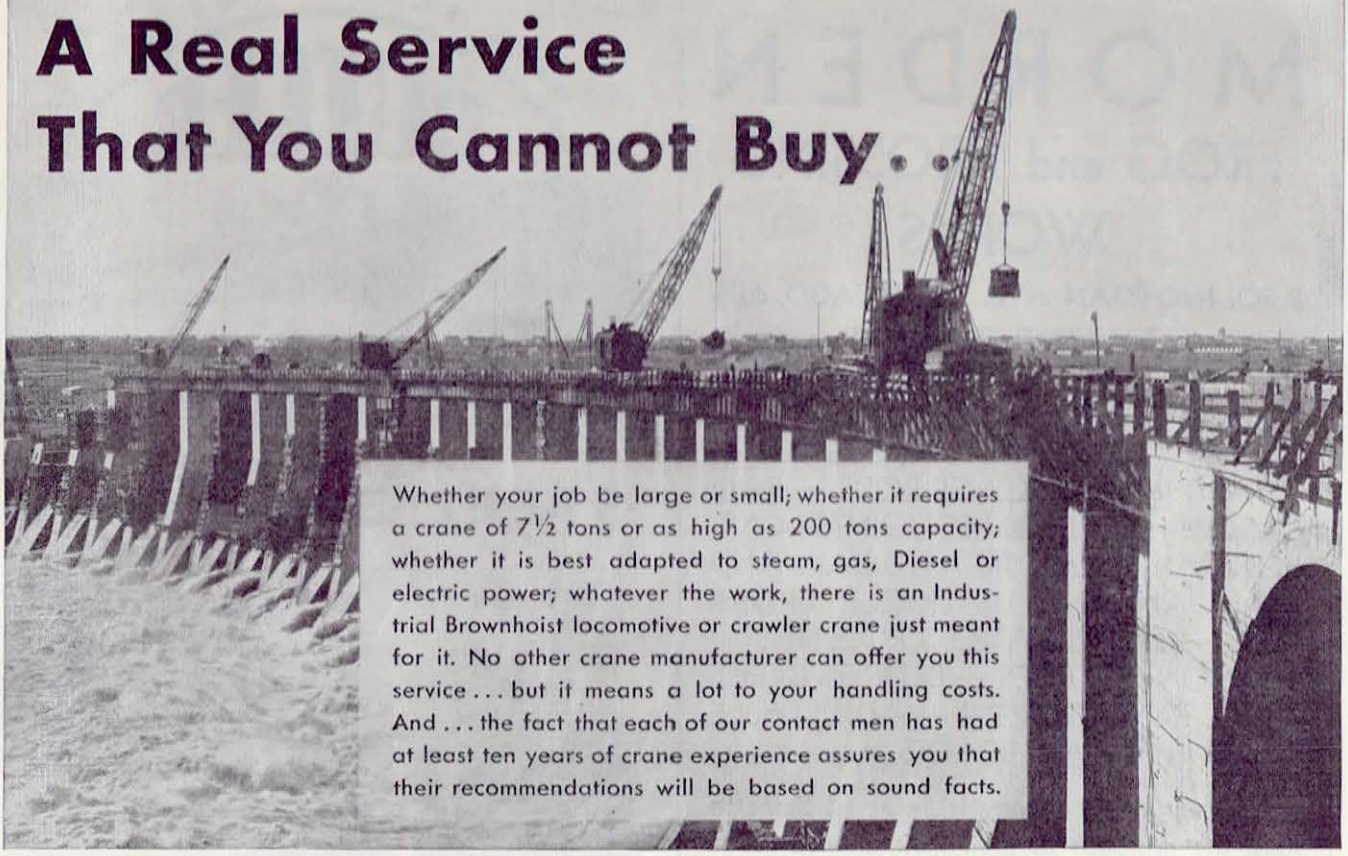

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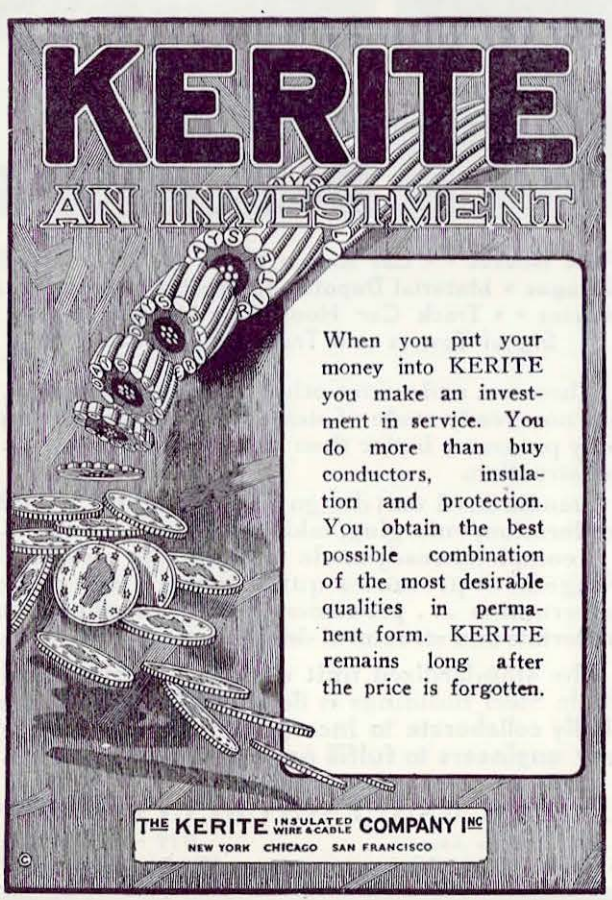

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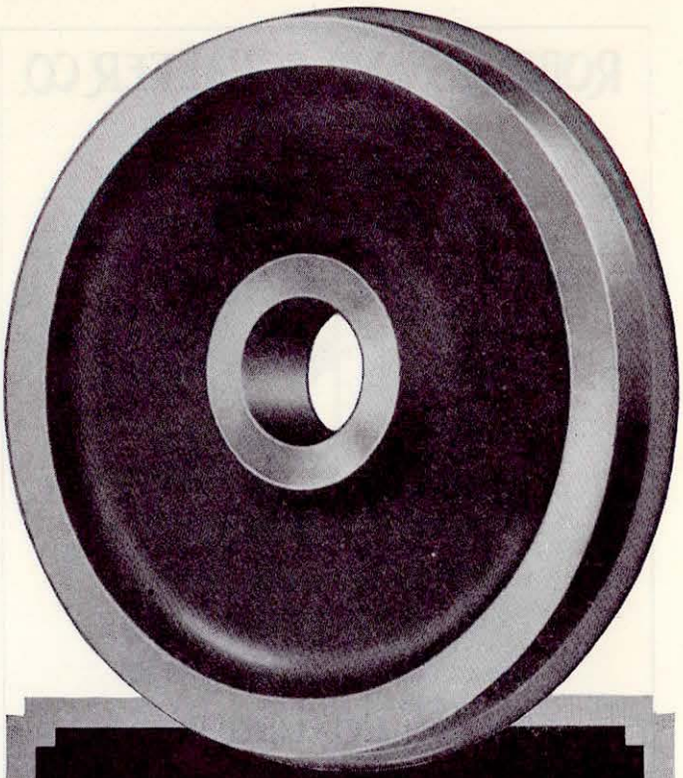

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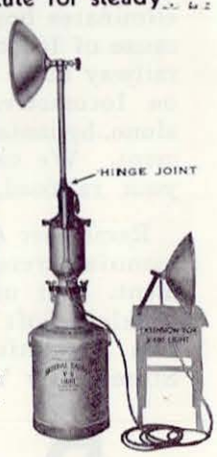

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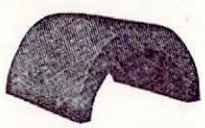
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Index to Advertisers

March 16, 1935

A

Air Reduction Sales Co. 10
Aluminum Co. of America 12
American Arch Co., Inc. 47
American Bridge Company 16
American Hair & Felt Co. 28
American Locomotive Co. 53
American Sheet & Tin Plate Co. 15
American Steel Foundries 11
American Steel & Wire Co. 14, 15
Armco Culvert Mfrs. Assn. 13

B

Baldwin Locomotive Works, The 39
Belmont Iron Works 63
Bethlehem Steel Company 3
Bixby, Inc., R. W. 63
Bond Electric Corp. 62
Budd Mfg. Co., Edward G. 41
Butler Mfg. Co., The 59

C

Camel Sales Company 63
Canadian Westinghouse Co. 40
Cardwell Westinghouse Co. 40
Carnegie Steel Co. 15, 17, 18
Classified Advertisements 63
Climax Molybdenum Co. 30
Columbia Steel Co. 15

D

Dearborn Chemical Co. 19
DeVilbiss Co., The 58
Dry-Zero Corporation 28

E

Edgewater Steel Company 61
Electric Storage Battery Co., The 31
Electro Chemical Eng. Corp. 23
Electro Metallurgical Company 33
Evans Products Co. 32

F

Fairbanks, Morse & Co. 37
Franklin Railway Supply Co. 46

G

Gale Service & Construction Co. 63
General Electric Co. 8, 9, 26
General Petroleum Corp. of Calif. 6, 7
General Railway Signal Co. 4, 5
Get Together Department 63
Gold Car Heating & Lighting Co. 63
Goodyear Tire & Rubber Co., The 54
Graybar Electric Co. 58

H

Harbison-Walker Refractories Co. 47
Hunt Company, Robert W. 63
Hunt-Spiller Manufacturing Corp. 66

I

Illinois Steel Company 15, 18
Indiana Steel & Wire Co. 62
Industrial Brownhoist Corp. 60
Ingersoll-Rand Co. 35
Ingot Iron Railway Products Co. 13
Inland Steel Company 34
International Creosoting & Construction Co. 2

J

Johns-Manville Co. 36
Jones & Laughlin Steel Corp. 38

K

Kerite Insulated Wire & Cable Co., Inc., The 60

L

Lima Locomotive Works, Inc. 45
Locomotive Firebox Co. 20
Lorain Steel Co., The 17
Lubrite Refining Corporation 6, 7

M

Magnolia Petroleum Company 6, 7
Magnus Company, Inc. 61
Morden Frog & Crossing Works 59

N

National Aluminate Corp. 42
National Bearing Metals Corp. 63
National Carbide Sales Corp. 62
National Tube Company 15
New York Air Brake Co., The 56

O

Okonite Company, The 29
Okonite-Callender Cable Co., Inc., The 29
Oxweld Railroad Service Co., The 27

P

P. & M. Company 63
Permutit Co., The 61
Portland Cement Assn. 24
Professional Directory 63
Pyle-National Co., The 23

R

Railway Educational Bureau 63
Ramapo Ajax Corporation 22
Reading Iron Company 60
Republic Steel Corporation 44
Roberts and Schaefer Co. 62
Ross and White Co. 63

S

Socony-Vacuum Oil Co., Inc. 6, 7
Sperry Rail Service, Inc. 21
Standard Oil Company of New York 6, 7
Superheater Company, The 52

T

Timken Roller Bearing Co., The 57

U

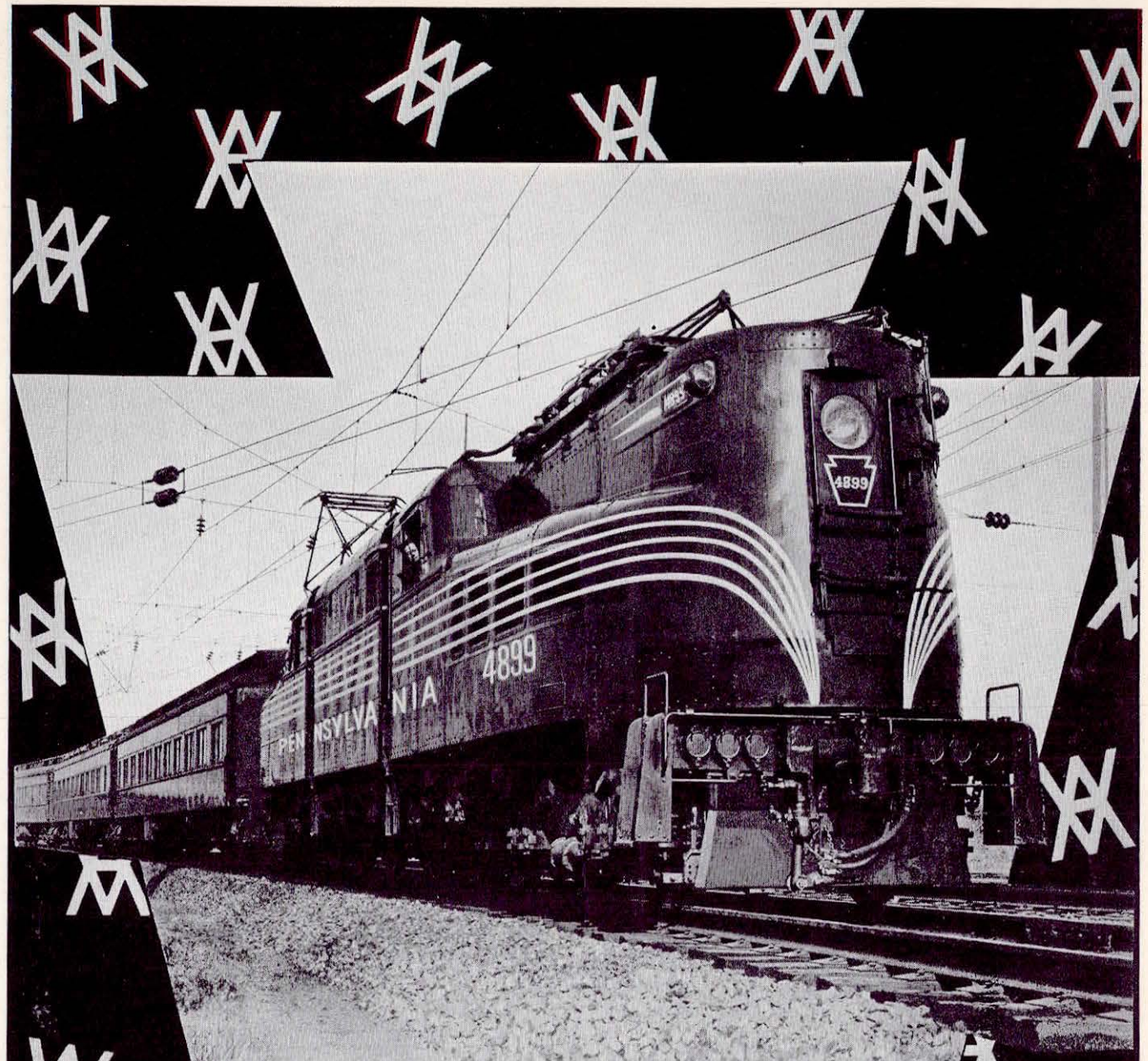
Union Carbide & Carbon Corp. 27, 33
Union Switch & Signal Co. 48, 49, 50, 51
Unitcast Company, The Front Cover
U. S. Steel Subsidiaries 15, 16, 17, 18

W

Wadhams Oil Company 6, 7
Westinghouse Air Brake Co. 65
White Eagle Oil Corporation 6, 7
White Star Refining Company 6, 7
Wine Railway Appliance Co. Front Cover
Woodings-Verona Tool Works 55

Y

Youngstown Sheet and Tube Co., The 25



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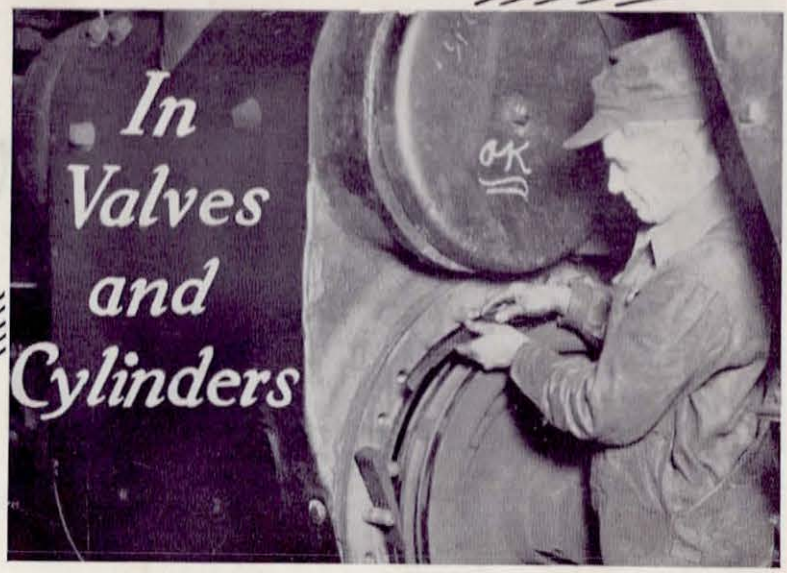

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